

Willow Brook and Willow Brook Pond

Revised October 2001

Revised July 2001

November 2000

PREPARED FOR:

UNITED TECHNOLOGIES CORPORATION

PRATT & WHITNEY

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East Hartford, CT 06018

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Comm. No.88UT002

REMEDIATION ACTION WORK PLAN

**United Technologies Corporation
Pratt & Whitney
Willow Brook and Willow Brook Pond
East Hartford, CT**

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1.0 INTRODUCTION

1.1 General

This Remedial Action Work Plan (RAWP) has been developed to present the approach and strategy for the remediation of Polychlorinated Biphenyl (PCB) contaminated sediment within Willow Brook and Willow Brook Pond at the United Technologies Corporation (UTC), Pratt & Whitney (P&W) manufacturing facility in East Hartford, Connecticut (Site). A Site Location Map is included as Figure 1-1. The remediation approach consists of the excavation and offsite disposal of soil and sediment from within and immediately surrounding Willow Brook and Willow Brook Pond that contains PCBs at concentrations greater than 25 milligram per kilogram (mg/kg or parts per million (ppm)).

Following excavation, a geotextile, soil and rock cap (engineered control) will be installed over the entirety of Willow Brook Pond and the open channel of Willow Brook from Willow Brook Pond to Main Street. The exceptions to this approach is the wetland downgradient of the dam where excavation of soil at concentrations greater than the Residential Direct Exposure Criteria for PCBs will be performed and the area backfilled and planted to restore the wetland, and the footprint of the process water facility where soil will be remediated to meet the Residential Direct Exposure Criteria for PCBs for soils within 4-feet of the final grade, the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for soils above the seasonal high water table, prior to the placement of backfill. This particular alternative necessitates a variance to the criteria of the Remediation Standard Regulations (RSRs). In accordance with 22a-133k-2(f)(2)(A) and (B) of the Regulations of Connecticut State Agencies (RCSA), a request to use an engineered control (Request for Variance) was submitted to the Commissioner of the Connecticut Department of Environmental Protection (CTDEP) in January 2001 and was subsequently revised in response to CTDEP comments in May 2001. This report, coupled with the May 2001 revision of the January 2001 Request for Variance, have been prepared to satisfy these requirements. The Request for Variance is incorporated herein by reference.

Following remediation, the open channel of Willow Brook from the pond to Main Street will be restored to the current configuration. In response to a request by the Department of Environmental Protection (DEP) staff, the Willow Brook stream channel will be slightly modified between the dam that impounds Willow Brook Pond and Main Street to reduce the slope of the banks to control potential erosion and to modify the character of the channel bottom to create a low flow channel with pools and eddies. Willow Brook Pond will be restored to the current configuration. The proposed sediment cap will be installed throughout the pond bottoms. Due to the thickness of the cap (3-feet) and based on the proposed sediment removal volume, the final bathymetry within the ponds will be slightly modified to accommodate the proposed cap section.

The limits of the project are defined in two separate areas (upstream of the dam and downstream of the dam) and each area in two separate parts. The limits of the project area upstream of the dam is defined in two parts, Willow Brook Pond and the area of the former oil/water separator. The project area downstream of the dam is defined in two parts, the stream channel of Willow Brook Pond and the wetland area. It is recognized that the potential exists that contamination may exist outside these project limits. However, the intent of this remediation project is to address soil and sediment within and immediately surrounding Willow Brook and Willow Brook Pond. Measures to address contamination beyond those limits described below would be addressed in the future as separate projects.

1.1.1 Upstream of the Dam

Willow Brook Pond: With one exception, the lateral limit of the project area of Willow Brook Pond, inclusive of the small embayment west of the Process Water Facility and the footprint of the process Water Facility, is defined as the horizontal location of the ordinary water level (reference Drawing 1-1). The single exception is the location east of the upper section of Willow Brook Pond in the vicinity of a single soil boring WT-SB-132 (see Appendix A). The project area encompasses this boring to the limits shown on Drawing 1-1. Remediation, if necessary, beyond the limits shown will be performed as a separate project.

Former Oil/Water Separator: The lateral limits of the project area in the vicinity of the former oil/water separator is currently defined as the lateral limit of soils containing PCBs at concentrations greater than 25 ppm. However, it is recognized that the potential exists that PCBs and other constituents may exist in soils outside this lateral limit that would require remediation as part of the project. The current estimate of the lateral limits of the project in this area are depicted on Drawing 1-1.

1.1.2 Downstream of the Dam

Stream Channel Cap: The lateral limit of the project area for the stream channel cap is the 10-year flood elevation (22.0 to 24.0 feet above mean sea level) as shown on Drawing 1-1).

Wetland Area: The lateral limit of the project area for the wetland is currently defined to the south by the northern limit of the stream channel cap and to the north, east and west as the lateral limit of soils containing PCBs at concentrations greater than the Residential Direct Exposure Criteria. The lateral limits of these areas are also depicted on Drawing 1-1.

As discussed subsequently in this section, semi-volatile organic compounds, petroleum hydrocarbons and select metals were also detected in soil and sediment within and immediately surrounding Willow Brook and Willow Brook Pond. These constituents are commingled with soil and sediment containing PCBs. These constituents will remain in place in those areas in which they are commingled with soil and sediment containing less than 25 ppm PCBs and will be rendered inaccessible with the geotextile, soil and stone cap.

In summary, the components of the remediation approach include:

- The excavation and installation of a temporary lined by-pass channel with inlet and outlet structures;
- The demolition of the existing process water facility building structures and the offsite disposal of construction demolition debris;
- The removal and offsite disposal of the former oil/water separator located between upper and lower Willow Brook Pond and the excavation and complete removal of the structure with offsite disposal of impacted soil and concrete and the placement of an engineered control to achieve compliance with the variance provisions in the RSR;
- The excavation and offsite disposal of approximately 8,500 cubic yards of soil and sediment containing total PCBs at concentrations greater than 25 ppm from within and immediately surrounding Willow Brook and Willow Brook Pond;

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- The excavation and offsite disposal of approximately 1,500 cubic yards of soil and sediment containing PCBs at concentrations between 1 and 25 ppm from within and immediately surrounding the wetland area located north of Willow Brook;
- The excavation and offsite disposal of approximately 2,500 cubic yards of soil and sediment from within the open channel of Willow Brook to allow for the installation of the geotextile, soil, and stone cap within the stream channel;
- The placement of a geotextile, soil and stone cap (engineered control) over the entirety of the excavated area (with the exception of an approximately 1-acre wetland described below and the footprint of the process water facility) to isolate sediment containing less than 25 ppm total PCBs commingled with semi-volatile organic compounds, petroleum hydrocarbons, and select metals to achieve compliance with the variance provisions in the RSR;
- The restoration of an approximately 1-acre wetland located downstream of the Willow Brook Pond Dam; and
- The implementation of two institutional controls consisting of 1) an Environmental Land Use Restriction to ensure the affected area will not be used for residential purposes and to prohibit excavation; and 2) installation of a fence around the entire area to preclude access to Willow Brook and Willow Brook Pond.

1.2 Background Information

The UTC/P&W facility is located at 400 Main Street in East Hartford, Connecticut, and is approximately 1,100 acres in size. P&W initiated aircraft engine manufacturing operations in East Hartford in December 1929. Current site operations are conducted in a 6.5 million square foot complex and include administration and management, manufacturing, testing, research and development and ancillary services. All of these activities take place in the western portion of the 1,100-acre property. The Rentschler Airport and the Klondike Area occupy the eastern portion of the property. P&W previously used these two areas as an airport and a storage/testing area, respectively.

The Willow Brook and the Willow Brook Pond remediation area is about 4 acres in size as depicted in Drawing 1-1. The site is within a mixed residential, commercial, and industrial area of East Hartford, Connecticut. Property usage in the vicinity of the proposed RA area includes the following:

- UTC/P&W parking facilities and the Rentschler Airport, to the east;
- Apartment complex and residential areas to the north;
- A commercial business, parking facilities, and UTC/P&W manufacturing to the south; and
- Predominantly commercial areas with some residential to the west (across Main Street).

1.2.1 Site Description

Willow Brook is a small stream transecting the UTC/P&W facility from the northern portion of the Rentschler Airport through to the northwest portion of the current UTC/P&W operations complex. Willow Brook flows in a southwesterly direction in an open channel from the Rentschler Airport, is then hard-piped underground to the inlet of Willow Brook Pond, and continues from the pond as an open channel to a culvert under Main Street. From Main Street, Willow Brook flows in an open channel for a distance of approximately 2,500 feet to the confluence with the Connecticut River (see Figure 1-1). Willow Brook Pond is a man made water body located in the northern portion of the Site (See Drawing 1-1). The pond, a single body of water when first created, has been modified various times through the years. It is now comprised of two ponds subdivided by a culvert.

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Known water discharges to surface water that have existed at one point in time or another at the P&W East Hartford Facility include Discharge Nos. 001 through 015. The principal discharge from the facility is Discharge 001. Discharge 001 is the discharge of effluent from the dilute wastewater treatment plant at Colt Street. The other water discharges are permitted through the National Pollutant Elimination System (NPDES) program and are comprised mostly of cooling water and stormwater runoff. Only Discharge Nos. 001 through 004 and 007 through 009 are or were associated with Willow Brook or Willow Brook Pond. These discharges contained basement dewatering, industrial waters and process wastewater. Some of the discharges to the pond were routed through an oil/water separator. A map showing site wide discharge locations was previously provided in the *Work Plan for Willow Brook and Willow Brook Pond PCB Investigation*, prepared by LEA and dated December 12, 1997.

The majority of the water historically drawn from Willow Pond was used in buildings as a source of process water. The water was then collected and rerouted back to Willow Pond via NPDES discharge 003 and 004 and the Willow Brook via NPDES discharge 002. Historically water has discharged through the Experimental Test Airport Laboratory (ETAL) to Willow Brook upstream of Willow Pond. Basement dewatering operations and industrial waters had discharged through an oil/water separator into the brook. This building has been demolished and the oil/water separator water was removed.

During routine draining of Willow Brook Pond in September 1997, an oil sheen was noticed seeping through the sediment. P&W reported the sheen to the United States Coast Guard and the CTDEP in accordance with discharge reporting requirements. Following the detection of PCBs in a sample, the CTDEP issued P&W a NOV, No. PCB 97-08, on November 7, 1997. In response to the NOV, UTC/P&W developed a sampling work plan and conducted three phases of remedial investigation from December 1997 to April 1999. These investigations identified the probable sources and provided the analytical data to sufficiently define the horizontal and vertical limits of contamination allowing development of a remediation plan.

1.2.2 Physical Setting

Physiography

The UTC/P&W East Hartford facility lies within the Central Lowland province of Connecticut, a north-south trending valley system, which is approximately 20 miles wide at East Hartford. The valley system consists of a series of parallel valleys separated by linear north-south trending ridges. The Connecticut River flows southward just west of the site and drains the northern part of the valley system, ultimately discharging to Long Island Sound. The Connecticut River Valley, which is 5 to 6 miles wide and flat (local relief on the order of 30 feet), has created a broad floodplain and eroded terraces in the flatter portion of the valley system. The central portion of the Connecticut River Valley was occupied during deglaciation of the area by a large glacial lake. This lake, known as Glacial Lake Hitchcock, was formed during the northward retreat of the last continental ice sheet and existed about ten thousand years ago.

A regional drainage divide between the Connecticut River Basin and Hockanum Regional Basin lies to the north of the site and approximately 3 miles to the east of the site. The Hockanum River is a tributary of the Connecticut River.

Surface Water

From a review of the "Water Quality Classifications Map of Connecticut," published in 1987 by the CTDEP, surface water quality in Willow Brook has been designated as "B" along its entire reach to the

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confluence with the Connecticut River. As noted, the Willow Brook/Connecticut River confluence is approximately 2,500 feet from the Main Street culvert. The "B" designation indicates Willow Brook is known or presumed to meet water quality criteria for recreational use, fish and wildlife habitat, agricultural and industrial supply, and navigation. The Connecticut River has been designated "SC/SB." This designation indicates that the water quality in the river does not presently meet class "SB" water quality criteria for one or more designated uses, but the goal is to meet class "SB" criteria. Designated uses for class "SB" include potential for certain fish and wildlife habitat, recreational boating, industrial supply, and other legitimate uses including navigation.

Storm water

Surface water drainage in the immediate vicinity of Willow Brook and Willow Brook Pond is predominantly overland sheet flow. Storm water in the adjacent plant area is handled by a number of catch basins, roof drainage systems, and storm drain pipelines, which discharge directly into Willow Brook or through an oil/water separator prior to discharge to Willow Brook. The Flood Insurance Rate Map, prepared by the Federal Emergency Management Agency and dated October 23, 1981, for East Hartford, Connecticut (Community No. 090026 0003-D Panel 3 of 4), shows the projected 100-year floodplain of the Willow Brook area. Most of the flood-prone areas depicted along Willow Brook lie between the 100-year to 500-year floodplain.

Meteorology

The climate of central Connecticut is a cool, humid, modified oceanic type. Winters are long and moderately cool; summers are short and mild. The mean annual temperature is approximately 50 degrees Fahrenheit (°F), ranging from an average of approximately 28°F in January to an average of 73°F in July. The average annual precipitation of approximately 44 inches is fairly evenly distributed throughout the year (National Oceanic and Atmospheric Administration, 1990); snowfall is about 40 inches per year (Soil Conservation Service, 1962). The prevailing wind is from the south or southwest in spring and summer and from the north or northwest the rest of the year.

1.2.3 Regional and Site Geology

Regional Geology

The geology of the region consists of sedimentary and igneous bedrock overlain by unconsolidated sediments. The UTC/P&W East Hartford facility is situated in the central portion of the Hartford Basin of the Newark Terrain. The rocks of the Hartford Basin were originally deposited as sediments or as the result of volcanic activity in a rift valley setting. The bedrock stratigraphy consists of four terrigenous sedimentary rock formations: the New Haven, Shuttle Meadow, East Berlin, and Portland. These units are composed of interlayered reddish siltstones, sandstones, and conglomerates. The sedimentary formations are separated from each other by three laterally continuous basalt units: Talcott, Holyoke, and Hampden Basalts. The bedrock layers dip gently eastward and are crosscut by numerous steep faults.

The unconsolidated sediments in much of the region can be divided into three major units: glacial till and limited deposits of stratified sand and gravel, glaciolacustrine deposits, and post-glacial fluvial deposits. These three units were deposited in this order, with the till and the limited stratified sand and gravel deposits generally lying directly over bedrock.

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The till is poorly sorted and varies widely from a non-compact mixture of sand, silt, gravel, and cobbles with trace amounts of clay to a compact mixture of silt and clay with some sand, gravel and cobbles. The till is typically less than 10 feet thick in the vicinity of the UTC/P&W facility. The stratified sandy sediments (stratified drift) are much less extensive than the till and usually consist of sand, gravel and silt deposited by melt water in contact with or in front of the glacier. These sediments appeared to be of limited extent and occurred in relatively thin layers (less than 10 feet) beneath the UTC/P&W facility.

Glaciolacustrine deposits include both lake-bottom sediments consisting of silt and clay and sand and gravel deposits formed by beaches and deltas in the lake. Thicknesses of lacustrine clays and silts as great as 270 feet have been reported beneath the UTC/P&W facility. These deposits are thickest in areas of deep bedrock valleys, one of which trends north-south and underlies the Main Plant Area. In a few isolated cases, thin layers of gravelly sands have been documented within the deeper portion of the glaciolacustrine unit.

Post-glacial fluvial sediments generally consist of sand and gravel deposited as the Connecticut River flowed across the exposed lake bed and cut stream terraces into the exposed lacustrine clays and silts, creating stream terrace deposits. These deposits are laterally extensive over the UTC/P&W facility, and are typically 15 to 30 feet thick across the facility.

Site Geology

Bedrock beneath the UTC/P&W facility consists of red sandstone and siltstone of the Portland Formation. Depth to bedrock within the facility boundaries is over 300 feet in the Main Plant Area, and approximately 30 feet along the eastern property boundary. Near the western property boundary along the Connecticut River, depth to bedrock is about 150 feet. A north-south trending, buried bedrock valley underlies the UTC/P&W facility; this buried valley may have been a pre-glacial channel of an ancient river following a similar course to that of the Connecticut River.

A thin layer of glacial till, up to 10 feet thick, typically directly overlies bedrock. A gravelly sand stratified drift deposit has been reported above or in place of the till in a few isolated instances.

Glaciolacustrine lake bottom sediments occur over most of the UTC/P&W facility, and range in thickness from 9 to 270 feet. These deposits thicken towards the central part of the facility (near the Main Plant Area) and are generally absent near the eastern boundary of the site.

The deposits consist of laminated (varved) silts and clays with red fine sand partings. The color varies from gray near the surface to red at the base of the unit. The presence of local sand or gravel lenses within the glaciolacustrine unit near its base has also been reported, but these are not assumed to be laterally extensive.

Beneath the eastern portion of the site, the contact between the silt and clay and overlying sediments is distinct. However, in the Main Plant Area, an intermediate layer of fine sand and silt that varies in thickness from approximately 5 to 20 feet occurs between these two deposits. A similar zone may occur at the base of the glaciolacustrine unit as well; these zones are typical of depositional facies changes that are characteristic of the depositional environment (glaciolacustrine).

Post-glacial fluvial deposits on the UTC/P&W facility are floodplain sediments of the Connecticut River. As the river cuts a channel through the floodplain, terraces were formed along the banks. The stream terrace deposits occur across the facility and generally range from 15 to 30 feet in thickness. These

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deposits increase in thickness toward the central part of the facility where greater erosion of the top of the glaciolacustrine silt and clay may have occurred along a former (perhaps earlier post-glacial), abandoned channel of the Connecticut River. These deposits generally consist of uniform brown fine, or fine-to-medium, sand. More recently deposited laminated silt and sand (alluvium) occurs near the western boundary of the site. This alluvium is thickest near the Connecticut River and likely interfingers with the older stream terrace deposits. Other recent alluvial deposits are found scattered across the facility near existing and former streams or wetland areas.

1.3 Summary of Previous Investigations

This section presents a summary of the three previous phases of investigation conducted at Willow Brook and Willow Brook Pond from December 1997 to April 1999. A summary of the analytical results for the entire sampling program is included as Appendix A in a series of detailed site plans developed by LEA during the remedial investigation.

The investigations identified some probable sources and provided the analytical data to define the horizontal and vertical limits of contamination in sufficient detail to allow for the development of a remediation plan. Figures 1-2 and 1-3 present an overview of the delineation of the extent of PCBs in soil and sediment within and immediately surrounding Willow Brook and Willow Brook Pond.

Phase I: *Report on PCB Investigation for Willow Brook and Willow Brook Pond Sediment*, prepared by LEA, dated February 13, 1998. The purpose of this report was to present the findings of the PCB investigation conducted on Willow Brook and Willow Brook Pond sediment in order to address the requirements of item (1) of the third paragraph of the NOV, No. PCB 97-08 issued by the CTDEP and dated November 7, 1997. The sampling was performed in accordance with the *Work Plan for Willow Brook and Willow Brook Pond PCB Investigation*, prepared by LEA and dated December 12, 1997, and approved by the CTDEP on December 22, 1997.

The report describes the field activities performed based on a predetermined sampling grid and presents the analytical results of the investigations. A Toxic Substances Control Act (TSCA) sampling grid was developed to specify the number and location of samples for the investigation in accordance with USEPA's guidance document "*Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup*". Two separate sampling grids were prepared for the east and west surface water bodies of Willow Brook Pond. The sampling was performed in accordance with the approved Work Plan, with the exception that the pond was not drained in response to CTDEP's concerns about sediment disturbance. Detectable PCB values on the sediment samples collected ranged up to a maximum concentration of 617 ppm total PCBs at sampling point WT-SD-33, located immediately downgradient of the subsurface connector between the eastern and western surface water bodies comprising Willow Brook Pond. Relatively high PCB concentrations were also observed in sediment samples collected in the vicinity of this location in both water bodies. Relatively elevated PCB concentrations were also observed along Willow Brook immediately downstream of Willow Brook Pond. A total PCB concentration of 327 ppm was observed in the sediment at location WT-SD-54. The results of the investigations indicated the presence of elevated PCB concentrations throughout Willow Brook Pond and in the section of Willow Brook between the pond and Main Street. The PCB concentrations observed beyond that point were below 1 ppm.

Selected sediment samples were also analyzed for volatile organic compounds (VOCs), semi volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), and the RCRA eight metals (arsenic, barium, cadmium, chromium, mercury, lead, silver, selenium) plus nickel, zinc.

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Among the limited sediment samples analyzed for these parameters, elevated levels of SVOCs were detected in the sediment at location WT-SD-47 in the eastern water body of Willow Pond. Some of the highest SVOC concentrations reported in that sample included pyrene (480 mg/kg), phenanthrene (514 mg/kg), fluoranthene (537 mg/kg), chrysene (232 mg/kg), etc. Some of the highest metal concentrations observed in this location included lead (153 mg/kg), zinc (152 mg/kg), barium (37.7 mg/kg), and nickel (36.4 mg/kg), etc. The only VOC compounds identified in this location included trichloroethylene (23 µg/kg), tetrachloroethylene (11.6 µg/kg), 1,1,1-trichloroethane (9.7 µg/kg), and 1,1-dichloroethane (10 µg/kg). Generally lower SVOC and VOC concentrations were observed in the other locations samples.

Elevated TPH concentrations were observed at WT-SD-47 (1,160 mg/kg) and WT-SD-09 (4,340 mg/kg and 3,940 mg/kg in the duplicate). Relatively elevated metal concentrations were also observed at this location (zinc 772 mg/kg and 689 mg/kg in the duplicate, nickel 595 mg/kg and 593 mg/kg in the duplicate, lead 714 mg/kg and 691 mg/kg in the duplicate, chromium 490 mg/kg and 497 mg/kg in the duplicate).

It should be noted that no sediment was encountered in upstream accessible locations along the Willow Brook conduit to allow sample collection. Several manholes along the subsurface conduit were opened to confirm no sediment had accumulated within the conduit. Historical measurements have indicated non-detectable PCB levels in sediment samples collected from upstream brook locations, prior to the conduit.

Based on the results obtained, additional investigations were determined to be necessary to better characterize the vertical extent of the contamination within Willow Brook and Willow Brook Pond and to identify potential nearby sources of contamination.

Phase II: *Report on Supplemental PCB Investigation for Willow Brook and Willow Brook Pond*, prepared by LEA, dated April 1998. The purpose of this report was to present the findings of the supplemental PCB investigation conducted on Willow Brook and Willow Brook Pond. The supplemental soil and sediment sampling was performed to identify potential nearby sources of contamination and to provide information of the vertical extent of the contamination within Willow Brook and Willow Brook Pond. An overview of the investigation of the potential source areas and the delineation of Willow Brook and Willow Brook Pond sediments is as follows:

Southwestern bank of Willow Brook Pond: This area was investigated to determine if infiltration or seepage from historic sludge drying beds located to the south of Willow Brook Pond was a potential source. Four soil borings were also installed at the southwestern bank of Willow Brook Pond downgradient of the historic sludge drying beds. The borings were advanced to a depth of 20 to 24 feet from the western bank of the pond. Low total PCB concentrations (up to about 2 ppm) were detected in the borings installed along the southwestern bank of Willow Brook Pond. These concentrations did not appear to be indicative of a source of PCB contamination.

Area of Former Oil Basin area, within the western section of Willow Brook Pond: This area was investigated to determine if infiltration or seepage from historic operations in the pond area was a potential source. The existing oil-water separator is currently operating in this area. Four soil borings were installed in the vicinity of the area of Former Oil Basin, the small embayment west of the Process Water Facility and south of the lower section of Willow Brook Pond. Two of these borings were installed on top of the bank immediately to the south of the area of Former Oil Basin using a Geoprobe® and advanced to a depth of 20 to 24 feet. The other two were installed by hand to a depth of 2 to 8 feet in the immediate proximity of the existing oil/water separator. PCBs were detected in the soils collected from

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the four soil borings; however, the highest total PCB concentrations were of the order of 1.3 ppm. These concentrations do not appear to be indicative of a source of contamination.

Former Oil-Water Separator, located historically in the area between the two sections of Willow Brook Pond: This area was investigated to determine if infiltration or seepage from historic operations in the Pond area was a potential source. Five soil borings were installed in the vicinity of the Former Oil-Water Separator in between the two sections of Willow Brook Pond to identify potential historic sources of PCB contamination. The soil borings were installed using a Geoprobe® to a depth of approximately 20 feet. Soil samples were collected every 2 feet and screened visually for the presence of oil. Three samples were submitted for analysis from each boring. Elevated total PCB concentrations were observed in the soil samples from this location. The total PCB concentration observed in this area ranged up to 128 ppm (location WT-SB-88) at a depth of 10 to 12 feet. Free oil was also observed in this location. However, the oil was not extracted from the soil matrix for analysis. The highest PCB concentrations were observed at a depth of approximately 8 to 12 feet below ground surface corresponding approximately to the depth of the water and sediment within the pond, and the approximate level of the water table in the area. These concentrations and findings from this area are indicative of a probable source. It should be noted that the contamination might have originated from multiple sources.

Sediment Sampling: In-depth sampling was also performed within the eastern and western water body of Willow Brook Pond, and along Willow Brook in the vicinity of the wetlands area, and in the wetland area within UTC/P&W's property. These samples were collected to develop at-depth profiling information. It should be noted that only surface sediment samples were collected during the initial Phase I investigation. A 5-foot core was used for collection of the sediment and underlying soil samples during Phase II. Generally, one sediment and two soil samples of the underlying soil were selected from each sampling location. Detected total PCB concentrations within the two sections of Willow Brook Pond (east and west) ranged in concentrations up to 258 ppm in the upper 0- to 2-foot interval. The highest concentration was observed in location WT-SD-72 near the pond's effluent point. Approximately 73.5 ppm of total PCBs were detected at a depth interval of 2 to 4 feet in location WT-SD-78, located at the eastern portion of Willow Brook Pond. Significantly lower and/or non-detectable levels were observed at greater depths. PCB concentrations remained at detectable levels at certain locations at depths up to 8 or 12 feet. Total organic carbon (TOC) concentrations up to 162,000 mg/kg were detected in sediment samples within Willow Brook Pond (location WT-SD-75 at a depth of 0 to 2 feet).

The total PCB concentrations detected in Willow Brook in the vicinity of the wetlands area and within the wetlands for surface samples (0 to 6 inches) ranged in concentration from 44 ppm up to 299 ppm (location WT-SD-92). The total PCB concentrations observed in the at-depth samples (1.5 to 2.0 feet) were significantly lower ranging from 2.6 ppm to 5.7 ppm.

Additional investigations were then proposed, focusing on the areas where the highest levels of PCB contamination were identified to further investigate and define the extent of contamination.

Phase III: *Report on PCB Investigation for Willow Brook and Willow Brook Pond*, prepared by LEA, dated April 1999. The purpose of this report was to present the findings of the third phase of PCB investigations in Willow Brook and Willow Brook Pond. During this phase, soil samples were collected from soil borings and monitoring wells installed in the vicinity of Willow Brook Pond. In addition, surface sediment and soil samples to depths of up to 6 feet were collected along the banks of Willow Brook. Soil/sediment samples were collected from the wetland area at Willow Arms and from other adjacent residential properties along the portion of Willow Brook, which lies downstream of Willow

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Brook Pond and to the east of Main Street. Groundwater sampling was also performed in monitoring wells installed at the perimeter of Willow Brook Pond.

Willow Brook Pond Perimeter Sampling: Twelve soil borings and eight monitoring wells were installed in the vicinity of Willow Brook Pond to assess the lateral extent of the contamination. The borings and monitoring wells were installed using a Geoprobe® to a depth of approximately 20 feet. Hand borings to an approximate depth of 12 feet were installed in locations inaccessible by the Geoprobe®. Soil samples were collected every 2 feet and screened visually for the presence of oil. Three samples were submitted for PCB analysis from each boring, including the most contaminated one, based on visual observations, and random ones corresponding approximately to the depth of contamination obtained during the previous investigation. Total PCB concentrations of 50.87 ppm were observed to the east of the eastern water body at Willow Brook Pond, along the reinforced concrete pipe that conveys flow from Willow Brook into Willow Brook Pond. Relatively elevated PCB concentrations up to 14.33 ppm were observed in the area of the Former Oil-Water Separator between the two sections of Willow Brook Pond. This is consistent with previous findings and provides delineation of contamination in this area. Elevated concentrations of semi-volatile organic compounds (SVOCs) and select metals have been observed at some locations. The elevated compounds are consistent and appear to be co-located with the elevated PCB concentrations.

PCBs may have seeped into nearby soils at certain locations, for example at location WT-PZ--140 to the north of the larger water body of Willow Brook Pond (3.82 ppm). However, concentrations detected at depth are generally much lower or below detectable levels. The contamination was confirmed to be primarily contained within Willow Brook Pond.

Wetlands and Stream Bank Sampling: Soil/sediment samples were collected from several abutting residential properties along the segment of Willow Brook between Willow Brook Pond and Main Street. The samples were collected at different elevations along the bank of the brook to assess the lateral extent of contamination. Samples were also collected from the wetlands area at the Willow Arms property and from the adjacent portion of UTC/P&W's property. Surface soil/sediment samples were collected in a total of 28 locations. In seven of these locations, hand auger borings were advanced to approximately 6 feet to assess the vertical extent of contamination. Relatively elevated PCB concentrations (up to 596.2 ppm) were observed within the wetland area. Relatively elevated SVOC and select metals concentrations were also observed within this area, and, as stated before, are consistent and co-located with elevated PCB concentrations. The total PCB concentrations typically decrease to less than 1 ppm at a depth of 4 to 6 feet below grade. Similar concentrations were observed in the wetland area within UTC/P&W property. Total PCB concentrations up to 21.77 ppm were detected from sediment within Willow Brook in the off-site properties (downstream of the wetland area). The PCB concentrations observed drop substantially at higher elevations along the bank of Willow Brook, indicating that the contamination is confined within the brook and the wetland. PCB concentrations decrease to less than 1 ppm prior to Main Street.

Groundwater Sampling: Groundwater samples were collected by LEA personnel from the installed monitoring wells on December 4, 1998. Samples were collected using a peristaltic pump and dedicated polyethylene tubing. Of the eight monitoring wells installed, PCBs were only detected at two locations. PCBs were detected in groundwater from monitoring wells WT-PZ-136 [8.5 parts per billion (ppb)] and WT-PZ-139 (0.73 ppb). These wells are in the vicinity of locations where the highest PCB concentrations in soil have been detected.

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Surface Water Sampling: Surface water samples were collected from two locations at Willow Brook Pond (at the pumps from the larger water body prior to entering the facility for non-contact cooling water use and at the dam) and from Willow Brook (downstream of Willow Brook Pond at the intersection with Main Street). No PCBs were detected in any of the surface water samples collected.

1.4 Nature and Extent of Contamination

1.4.1 Soil and Sediment

Overall and with consideration of the data collected to date, PCB concentrations are generally distributed in the brook and pond sediments gradually decreasing in concentration in the downgradient direction. This decrease trends from > 100 ppm in the pond and wetland areas to a concentration of < 1 ppm at Main Street. PCBs were also found in the soils between the two ponds, where the former oil/water separator was located. The vertical extent of PCB impacts has been defined by the sampling conducted, generally achieving non-detect or concentrations < 1 ppm at depths ranging from 4 to 6 feet below grade in the wetland area and 14 to 16 feet below grade in the soil between the upper and lower Willow Brook Pond (in the vicinity of the former oil-water separator). Soil samples collected along and up the banks of the brook and ponds define the horizontal limits of PCB to non-detect or concentrations of < 1 ppm. Figures 1-2 and 1-3 depict the extent of PCB impact in the Willow Brook and Willow Brook Pond area. Within the pond and brook the PCBs are commingled with SVOCs and select metals.

1.4.2 Groundwater

Groundwater samples collected during the remedial investigation identified only two locations where PCB concentrations were above detection limits (WT-PZ-136 at 8.5 ppb and WT-PZ-139 at 0.73 ppb). Well WT-PZ-136 is located in the immediate vicinity of the former oil/water separator and locations of high PCB content in soil. Well WT-PZ-139 is adjacent to an area of elevated PCB in soils. It is expected that removal of soil and source material in these areas will address PCB in groundwater. As these areas and the previously sampled monitoring wells will be removed during RA, post-excavation groundwater monitoring will be conducted to confirm no impacts to groundwater remain following excavation. This monitoring will be conducted through the installation of new monitoring wells in the area.

1.4.3 Surface Water

Surface water sampling from Willow Brook and Willow Brook Pond was performed on February 6, 1998. Samples were collected from Willow Brook Pond at the pumps pumping from the larger water body and dam and from Willow Brook downstream of Willow Brook Pond at Main Street. No PCBs were detected in any of the surface water samples collected.

2.0 STATEMENT OF WORK

The remediation plan for Willow Brook and Willow Brook Pond project as defined in Section 1.0, involves the excavation and offsite disposal of soil and sediment containing total PCB concentrations in excess of 25 ppm with the following exceptions. The exceptions to this approach is the wetland downgradient of the dam where excavation of soil at concentrations greater than the Residential Direct Exposure Criteria for PCBs will be performed and the area backfilled and planted to restore the wetland, and the footprint of the process water facility where soil will be remediated to meet the Residential Direct Exposure Criteria for PCBs for soils within 4-feet of the final grade, the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for soils above the seasonal high water table, prior to the placement of backfill.

Following excavation and removal of the impacted soil and sediment within Willow Brook and Willow Brook Pond, a cap consisting of an organic rich soil layer, a gravel layer and a stone layer will be placed within the limits of Willow Brook and Willow Brook Pond. The dam structure between Willow Brook Pond and the open channel section of Willow Brook will remain intact. The area will be restored to much the same configuration as exists today with two ponds (upper and lower Willow Brook Ponds) and an open channel (Willow Brook) from the downstream end of the pond to the cross culvert at Main Street. The existing wetland downstream of the pond will also be restored. Details regarding site restoration and capping are further discussed in Section 2.3.

As noted previously, soil and sediment within Willow Brook and Willow Brook Pond are also impacted by SVOCs, metals, and petroleum hydrocarbons. During the removal of PCB contaminated soil and sediment, a large percentage of the soils and sediment impacted by these constituents will also be removed. Remediation of other constituents of concern found in the remediation areas will be completed in accordance with the Remediation Standard Regulation (RSR), 22a-133k-1 through 3 of the Regulations of Connecticut State Agencies (RCSA). The remediation goals for the ancillary constituents are presented in tabular format in Appendix A and B to 22a-133k-2, more specifically the Residential and Commercial/Industrial criteria in Appendix A, the GB Mobility Criteria in Appendix B and/or alternative criteria in accordance with those specific provisions. In any event, any remaining contamination will be capped in accordance with the variance provisions in the RSR as noted previously. Following remediation, UTC/P&W will implement two institutional controls to ensure the long-term protectiveness of the proposed remedy. The institutional controls consist of 1) an Environmental Land Use Restriction to ensure the affected area will not be used for residential purposes and to prohibit excavation and 2) installation of a fence around the entire project area to preclude access to Willow Brook and Willow Brook Pond.

The proposed 25 ppm total PCBs action level within Willow Brook and Willow Brook Pond assumes future use of the remediation area as an open pond to be flanked by green space. However, as noted above, a perimeter fence will be installed to preclude free access to the remediated area. In the event that redevelopment of this area involves a bike path or roadway, the area directly beneath those uses will be remediated to a total PCB concentration of less than the Residential Direct Exposure Criteria. A release of the aforementioned Environmental Land Use Restriction by the Commissioner of the Department of Environmental Protection would be necessary before any redevelopment activities are initiated. Such release would necessitate the preparation of a detailed remediation and restoration plan, which would be consistent with the future proposed use of the subject area or part thereof. Furthermore, should redevelopment of the area necessitate remediation to less than the Residential Direct Exposure Criteria, appropriate barriers (i.e. fencing or railings) would be installed between the capped areas and the areas remediated to less than the Residential Direct Exposure Criteria.

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2.1 General

This section details the work to be completed during the project. The section begins with a discussion of pre-construction activities including the application for necessary Federal, State of Connecticut and Town of East Hartford permits to complete the work, and the design of the project. This is followed by a discussion of the construction activities including site preparation, the demolition and removal of existing structures, contaminated soil and sediment excavation and offsite disposal, wetlands restoration, site restoration activities, implementation of institutional controls, and record keeping and reporting. The last part of this section details post-construction activities. This includes a discussion on the preparation of a post-remediation report detailing the remediation activities and a post-remediation groundwater monitoring program.

2.2 Pre-Construction Activities

This section contains a description of those activities that will be completed prior to the initiation of PCB removal activities at the site. The pre-construction activities are presented in three general categories: project permits, engineering design, and health and safety plan.

2.2.1 Project Permits and Approvals

Prior to the initiation of construction activities and the completion of design activities, it will be necessary to obtain permits from a variety of regulatory agencies maintaining jurisdiction over the work. The agencies include the Army Corps of Engineers, the State of Connecticut Department of Environmental Protection, and the Town of East Hartford Inland Wetlands, and Planning and Zoning Commissions.

US Army Corps of Engineers

The work of this project involves the excavation of nearly 12,500 cubic yards of contaminated soil and sediment from within Willow Brook and Willow Brook Pond. The majority of the excavation activities occur within the two ponds, within the wetlands west of the ponds, or immediately adjacent to these areas. The construction activities will result in the disturbance of greater than 1-acre of wetlands within and immediately abutting the work. A permit from the Army Corps of Engineers is necessary prior to performing a construction activity that impacts greater than 1-acre of inland wetlands. In consideration of the fact that the project will result in the disturbance of greater than 1-acre of inland wetlands, the permit from the Army Corps of Engineers will be sought through the individual permit process. The permit application was filed on February 14, 2001 and has been issued. As part of this permit application, a public notice was issued. In response to the notice, the Army Corps of Engineers did not receive any substantive comments.

Connecticut Department of Environmental Protection

Prior to initiation of the construction activities, it will also be necessary to obtain a permit from the CTDEP Inland Water Resources Division. This permit will address the need to obtain a water quality certification for the excavation/placement of fill within the flood plain and wetlands pursuant to Section 401 of the Clean Water Act. The permit application was filed on February 14, 2001 and has been issued. Comments from the DEP on the application have been received and addressed in a revised submission. As part of this permit application, a public notice was issued. In response to the notice, the CTDEP Inland Water Resources Division did not receive any substantive comments.

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The application to the IWRD was prepared and submitted on forms approved by the DEP and included: a permit application transmittal form; the permit application for programs administered by the IWRD; the technical documentation form; an executive summary; a USGS site location map; a listing of all adjacent property owners; a soil scientists report; an engineering/hydrogeologic report; flood management consistency worksheets; an environmental report; an alternatives assessment; a flood contingency plan; and plans and drawings detailing the work.

In addition to the above pre-construction permit, it was also necessary to register for the General Permit for the Discharge of Storm Water and Dewatering Wastewaters Associated With Construction Activities and the General Permit for the Discharge of Groundwater Remediation Wastewater. In addition, based on flows anticipated to be generated during construction dewatering and limitations on quantity of water to be discharged to the Town of East Hartford wastewater treatment facility, a temporary authorization has been granted to allow for the discharge of treated groundwater to the Connecticut River. The CTDEP Bureau of Water Management has issued both General Permits as well as the Temporary Authorization. In addition, a Storm Water Pollution Control Plan (a requirement of the storm water general permit) has also been prepared.

In addition to the above permits, it will also be necessary to secure an approval for the use of an engineered control to remediate soil and sediment within the project area. The engineered control consists of the pond bottom/sediment, stream channel, and composite caps to be installed following excavation activities within the project area. The request was submitted to the CTDEP on January 5, 2001 in accordance with Section 22a-133k-2(f)(2)(B) of the Regulations of Connecticut State Agencies. The request was a detailed report and plan which was prepared to satisfy the requirements of the above referenced regulatory section and to document that the cost of excavation and offsite disposal of the polluted soil at the site is significantly greater than the cost of installing and maintaining an engineered control and conducting groundwater monitoring. The request further documented that the significantly greater cost outweighs the risk to human health and the environment if the engineered control fails to prevent the mobilization of, or human exposure to the remaining polluted soils. No substantive comments were received and the approval for the use of an engineered control was granted.

Town of East Hartford

Prior to the initiation of construction activities, it will be necessary to obtain three permits from the Town of East Hartford. These permits will be issued by the Inland Wetlands, and Planning and Zoning Commissions. The Inland Wetlands Commission permit will be necessary prior to the performance of construction activities within wetlands or within specified distances from a wetland. The Inland Wetlands Commission issued an approval for the project following a public hearing on the application on April 24, 2001.

The Planning and Zoning Commission permits will be in the form of a Major Flood Hazard Permit and a Soil Erosion and Sedimentation Control Permit. The Major Flood Hazard Permit will be necessary prior to performing construction activities within a flood hazard area of the Town of East Hartford. This application was submitted to the Town of East Hartford on May 7, 2001 and was approved on June 27, 2001. The Soil Erosion and Sedimentation Control Permit must be obtained prior to initiating a construction project, which includes disruption to greater than ½ acre of land in the Town of East Hartford. This application was submitted on May 29, 2001 and was approved on June 27, 2001. It should be noted, an Excavation Permit will not be necessary, as a special exception has been sought as the construction activities are being undertaken as part of a remediation project.

2.2.2 Engineering and Design

Prior to the implementation of the construction activities at the site, design drawings and technical specifications necessary to support permitting activities will be prepared to depict each phase of the project. The construction drawings will be used in support of applications to obtain necessary permits as well as to direct the efforts during the construction activities. The technical specifications will be of adequate detail to ensure that each phase of construction is performed in accordance with the terms and conditions of any permits obtained prior to the initiation of construction, this Remedial Action Plan, and other applicable local, state and/or federal requirements. The project is being performed as a design-build effort. As such, detailed design plans and specifications beyond that which are necessary to support the permitting efforts and to establish the performance criteria for the remediation project, are not necessary. The drawings and figures contained herein represent the current status of engineering design for the project. Additional engineering design is not anticipated, other than the anticipated minor field alterations necessitated by changed conditions.

2.2.3 Health and Safety Plan

A Health and Safety Plan (HASP) will be prepared prior to the initiation of construction activities. The HASP will detail safety organization, procedures, and personal protective equipment that are based on an analysis of potential site-specific hazards. The HASP, will meet the requirements of 29 CFR 1910 and 29 CFR 1926 (which includes 29 CFR 1910.120 and 29 CFR 1926.65). The HASP will include, but will not be limited to, the following components:

- Identification of key personnel - All on-site personnel involved with the construction activities at the site will be required to maintain Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Training (29 CFR 1910.120 and 29 CFR 1926.65) and the corresponding 8-hour refresher course update
- Training - A description of health and safety training requirements for supervisory and on-site personnel will be presented. Training requirements will include attending an initial site orientation prior to performing on-site activities
- Medical Surveillance - A description of appropriate medical examinations required for supervisory and on-site personnel.
- Site Hazards - A description of chemical, physical, and climatological hazards associated with the project.
- Work Zones - A description of the work zones that will be established during construction activities.
- Personnel Safety Equipment and Protective Clothing - A description of personnel protective equipment and protective clothing to be used and available on site.
- Equipment Cleaning - The methods and procedures for decontamination of personnel, materials, and equipment will be described.
- Confined Space Entry - A listing of confined spaces and description of procedures for confined space entry in accordance with Permit Required Confined Space Entry (29 CFR 1910.146).
- Excavation Safety - A description of excavation and trenching safety procedures as specified in 29 CFR 1926 Subpart P.
- Standard Operating Procedures and Safety Programs as required by applicable portions of 29 CFR 1910 and 29 CFR 1926.

2.3 Construction Activities

The proposed construction activities involve:

- The excavation and installation of a temporary lined by-pass channel with inlet and outlet structures;
- The demolition of the existing process water facility building structures and the offsite disposal of construction demolition debris;
- The removal and offsite disposal of the former oil/water separator located between upper and lower Willow Brook Pond and the excavation and complete removal of the structure with offsite disposal of impacted soil and concrete and the placement of an engineered control to achieve compliance with the variance provisions in the RSR;
- The excavation and offsite disposal of approximately 8,500 cubic yards of soil and sediment containing total PCBs at concentrations greater than 25 ppm from within and immediately surrounding Willow Brook and Willow Brook Pond;
- The excavation and offsite disposal of approximately 1,500 cubic yards of soil and sediment containing PCBs at concentrations between 1 and 25 ppm from within and immediately surrounding the wetland area located north of Willow Brook;
- The excavation and offsite disposal of approximately 2,500 cubic yards of soil and sediment from within the open channel of Willow Brook to allow for the installation of the geotextile, soil, and stone cap within the stream channel;
- The placement of a geotextile, soil and stone cap (engineered control) over the entirety of the excavated area (with the exception of an approximately 1-acre wetland described below and the footprint of the process water facility) to isolate sediment containing less than 25 ppm total PCBs commingled with semi-volatile organic compounds, petroleum hydrocarbons, and select metals to achieve compliance with the variance provisions in the RSR;
- The restoration of an approximately 1-acre wetland located downstream of the Willow Brook Pond Dam; and
- The implementation of two institutional controls consisting of 1) an Environmental Land Use Restriction to ensure the affected area will not be used for residential purposes and to prohibit excavation; and 2) installation of a fence around the entire area to preclude access to Willow Brook and Willow Brook Pond.

The following parts of this section describe in general each of the anticipated construction activities necessary to complete the remediation.

2.3.1 Site Preparation

Drawing 2-1 presents the general site preparation details associated with this project. The following is a general description of anticipated site preparation activities.

Erosion Control

Appropriate soil erosion and sedimentation control methods (e.g., silt fence, straw bale dikes, absorbent booms, etc. as depicted in Figure 2-1) will be installed to mitigate the transport of suspended solids or sediments downstream. A soil erosion and sediment control plan is a component of applications for local, state and federal permits. Due to the magnitude of excavation to accomplish the removal of contaminated soil and sediment, excavation activities may be suspended during periods of heavy precipitation.

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Clearing and Grubbing

The area in the immediate vicinity of Willow Brook and Willow Brook Pond is covered with a variety of vegetation, including the wetland areas (see Drawing 2-1). Vegetation ranges from mowed grass to mature trees. To gain access to perform the planned excavation activities, clearing and grubbing will be required. Cutting, processing, and appropriate disposal of heavy vegetation will be a component of the project. It is anticipated that stumps from trees located in areas known or suspected to be impacted by PCBs or other constituents will be disposed of at an offsite facility as PCB remediation waste. The remainder of the woody debris will be shipped offsite for volume reduction and/or disposal as a solid waste in accordance with the State of Connecticut Solid Waste Management Regulations.

Decontamination Facilities

Contractor equipment that has been in contact with contaminated soil and sediment will require decontamination prior performing work in an uncontaminated area or demobilization from the site. A decontamination pad or pads will be strategically located at the site adjacent to excavations and vehicle loading areas. Potential locations for decontamination facilities are shown on Drawing 2-1. The decontamination pad or pads will generally be constructed of a wood frame or similar materials, lined with heavy plastic, and include a layer of open stone. Equipment that has come into contact with contaminated soil and sediment will be cleaned with a pressure washer, scrub brushes and organic solvent using a double wash/rinse process in accordance with Subpart S of 40 CFR Part 761 over the decontamination pad.

Durable field sampling equipment (e.g., stainless steel trowels, plastic scoops, shovels, etc.) used to implement the Field Sampling and Analysis Plan will be decontaminated prior to each sample location to mitigate the potential for cross-contamination of samples collected for laboratory analysis. Decontamination will be performed in accordance with Standard Operating Procedures provided as Appendix B and in accordance with 40 CFR Part 761.79(b).

Wash water and detergents used in the decontamination process will be disposed of following pretreatment through a mobile water treatment system (described in more detail later in this document) to the sanitary sewer in accordance with the terms and conditions of the CTDEP General Permit for the Discharge of Groundwater Remediation Wastewater or to the Connecticut River following treatment through the P&W Colt Street Industrial Wastewater Treatment Facility in accordance with the terms and conditions of the Temporary Authorization granted by the CTDEP. The terms and conditions of the General Permit require removal of PCBs to a concentration of 1 µg/L and the terms and conditions of the Temporary Authorization require the removal of PCBs to a concentration of 0.5 µg/L prior to discharge to the Colt Street facility.

Site Security

Limiting access to the site during construction will be accomplished through the use of both existing and permanent fencing (refer to Drawing 2-1 and Figure 2-2), along the north side of Willow Brook and Willow Brook Pond, and temporary construction fencing to be installed along Willow Street. The fencing will be supplemented by the use of security personnel to ensure that unauthorized persons do not access the construction site during remediation activities.

2.3.2 Demolition and Removal of Existing Structures

As part of the remedial activities, select buildings and other structures will be demolished (see Drawing 1-1). A list and description of the primary structures to be demolished and removed are as follows:

- Five buildings and components associated with the process water facility; and
- The former underground oil/water separator located between the upper and lower sections of Willow Brook Pond.

Area Preparation

Prior to demolition, a complete survey of the structures and their components will be performed. The survey is necessary to determine decommissioning, demolition, and disposal requirements. UTC/P&W will be responsible for shutdown and removal of components they intend to reuse from the process water facility.

Process Water Buildings

Demolition of the process water facilities will extend to a depth necessary to achieve the project objectives of remediating PCB contaminated soil to meet the Residential Direct Exposure Criteria for soils within 4-feet of the final grade, the Commercial/Industrial Direct Exposure Criteria for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for soils above the seasonal high water table. Other related structures, such as pilings, erosion structures, etc., will also be demolished and removed to a depth necessary to achieve the project objectives. Pipes and utilities connected to these buildings will be abandoned or removed during the demolition activities or during the soil and sediment removal phase of the project. Utilities designated for in-place abandonment will be analytically assessed and decontaminated if necessary to achieve a 1 $\mu\text{g}/100\text{ cm}^2$, 10 $\mu\text{g}/100\text{ cm}^2$, or 25 $\mu\text{g}/100\text{ cm}^2$ for abandonment if located in a 1 ppm, 10 ppm or 25 ppm remediation area, respectively. Utilities located within an area of soil remediation shall be excavated and disposed of as bulk remediation waste.

A Civil War marker/gravestone is located to the east of the main water processing building. This feature shall be protected during all aspects of the work.

Former Oil/Water Separator

A buried oil/water separator is located between the upper and lower sections of Willow Brook Pond. This structure and surrounding soils are contaminated with PCBs. The oil/water separator, its contents, and the soil containing greater than 25 ppm PCBs surrounding the structure will be completely removed and disposed of at an offsite location during the project. If a light-non-aqueous phase liquid (LNAPL) is identified during excavation, the remediation will proceed until the LNAPL is removed in accordance with Section 22a-449(d)-106(f) of the Regulations of Connecticut State Agencies. However, it is anticipated that the presence of LNAPL is coincident with soils containing greater than 25 ppm PCBs and the removal of the LNAPL would be completed during excavation of those soils. Prior to removal of the structure, the oil/water separator will be exposed and any liquids will be removed, characterized, and disposed of at an offsite location.

Available analytical data are sufficient to delineate the three-dimensional extent of soil impacted by PCBs in the vicinity of the oil/water separator. However, the data are not adequate for the purposes of establishing the lateral limits of the composite cap to be installed in this area to address soils impacted by

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other constituents. As a result, prior to implementing the remediation in this area, soil borings will be advanced to a depth of 15 feet using the Geoprobe®. Soil samples will be collected from each Geoprobe® soil boring and analyzed for PCBs and constituents other than PCBs. The intent of the sampling will be to delineate the three-dimensional extent of other soils requiring remediation for other constituents pursuant to the RSRs. It is anticipated that soil samples will be analyzed for mass and SPLP metals (RCRA 8 plus copper, nickel and zinc), cyanide, VOCs, SVOCs, and TPH. The location of each soil boring is discussed in Section 4.0.

Demolition Debris Management

Further evaluation of the affected structures and components will be performed to determine disposal requirements prior to demolition. Appropriate samples will be collected and submitted for laboratory analysis to characterize the waste for disposal. Any demolition debris characterized as bulk PCB remediation waste shall be disposed of at a chemical waste landfill approved under 40 CFR 761.75. The sampling procedures and protocols are further discussed in Section 4.0, Field Sampling and Analysis Plan. It is anticipated that all material removed in the demolition process will be disposed of off site. An expected waste stream summary is presented in Section 4.0.

Soil Sampling and Analysis

Sampling and analysis of certain soils below and adjacent to the subject buildings and structures will be required to confirm horizontal and vertical limits, disposal and handling requirements. Soil confirmatory samples will be collected and analyzed in accordance with the Field Sampling and Analysis Plan presented in Section 4.0. The excavated and staged soil will be sampled for disposal characterization. The soil disposal characterization samples will also be collected in accordance with the Field Sampling and Analysis Plan. All confirmatory and disposal characterization samples will be analyzed in accordance with the Quality Assurance Project Plan in Section 5.0.

2.3.3 Contaminated Soil and Sediment Excavation and Offsite Disposal

This section presents a summary description of the planned soil and sediment excavation and offsite disposal activities. As noted, it is anticipated that approximately 12,500 cubic yards of contaminated soil and sediment will be excavated and disposed of at an offsite location during the project. The proposed by-pass channel was incorporated into this project primarily to facilitate in-situ dewatering and to mitigate potential logistical complications associated with other water handling options. Based on the available historic stream channel bathymetry and utility invert data, the by-pass channel is expected to effectively relieve the groundwater table to an elevation below 21.00 in the pond areas. A field determination will be made based on the percent solids observed in the in-situ material, to excavate the material and direct-load the haul vehicles for off-site disposal, or to excavate the material and stage it in a temporary staging area for further gravity dewatering. The staged material would again be evaluated after a 24-hour period to assess the percent solids. If the percent solids are unacceptable for over-the-road transport, lime will be added to the material to further stabilize it and to achieve compliance with shipping requirements.

If it is determined that material staging in stockpiles is necessary to facilitate the offsite disposal of the contaminated soil and sediment, a material staging and stockpile area will be constructed. The material staging and stockpile area construction and operation is discussed in greater detail below.

Contaminated soil and sediment will be characterized for disposal based on the "as-found" concentration of PCBs. Additional analysis will be performed on stockpile grab samples as needed to satisfy the

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disposal vendor. The waste will be disposed of based upon the more restrictive analytical data regardless of the as-found concentrations (e.g. if in-situ characterization documents < 50 ppm PCBs and the stockpile data suggests > 50 ppm, the waste disposal profile used for this particular load would be based on the stockpile data). Stockpile analytical data would not be used to reduce any disposal restrictions on the material.

Stream Flow During Construction

The construction project involves the excavation of submerged sediments from within Willow Brook and Willow Brook Pond. Remediation will begin at the upstream pond and progress downstream. To accomplish the excavation, it will be necessary to temporarily redirect flow within Willow Brook.

During construction, all flow entering the PCB remediation work area from the upstream conduit of Willow Brook will be bypassed by the construction of a channel capable of conveying a 100 year flood as defined by the Flood Insurance Study prepared for the Town of East Hartford in January of 1979. The bypass channel will be constructed on the south side of the Willow Brook and Willow Brook Ponds as depicted in Drawing 2-2 and as detailed in Figure 2-3 through 2-5. Provisions will be made to direct local drainage that enters the work area directly from storm sewers on United Technologies Corporation, Pratt & Whitney property on the south side of the work area into the bypass channel. Storm water discharges from municipal and privately owned storm sewers that enter the work area from the north will either be conveyed or pumped around active work areas. During a 500-year flood, the hydraulic gradient above the work area would be higher than the conduit, and the backwater would cause some catch basins to be surcharged above the surface elevation of the inlets upstream of the conduit outlet. Provision has been made to seal the catch basins within the temporary staging and stockpile areas upgradient of the conduit outlet and to block surface flow from entering either the work area or the storage areas.

Dewatering

In addition to water diversion, it is also likely that construction dewatering will be necessary to facilitate the removal of soil and sediment containing greater than 25 ppm total PCBs. Conventional sump or well-point techniques will be employed to allow for spot dewatering of excavation areas. All dewatering wastewater will be containerized, treated as necessary, sampled, then discharged to either the Town of East Hartford Water Pollution Control Facility or back into The Connecticut River. Discharge to the Town of East Hartford Water Pollution Control Facility will be accomplished through a sanitary sewer and will be in accordance with a general permit, issued by the DEP, for the Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer. Discharge to the Connecticut River will be performed in accordance with the Temporary Authorization to be issued by the DEP. The temporary authorization will require the removal of PCBs to a concentration of less than or equal to 0.5 µg/L. All related monitoring and record keeping shall be implemented as mandated by either the general permit or the Temporary Authorization. A copy of the general permit and the Temporary Authorization is provided as Appendix C.

Excavation Methods

The excavation program will advance from upstream to downstream within Willow Brook Pond and the Willow Brook streambed. The approximate horizontal limits of the soil and sediment removal activities are presented on Drawing 2-3. Based on the prior investigations, it is anticipated that an average of 2 to 3 feet of sediment will be removed from the pond and brook, respectively and up to 4 feet within the wetland area. Soil from depths of up to 16 feet will be excavated in the vicinity of the former oil/water separator. Confirmatory soil samples collected during the remediation will provide the final horizontal

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and vertical limits of excavation. The soil and sediment excavation will be accomplished through the use of track-mounted excavators, bulldozers, and loaders. It is likely that some or all of the equipment will be of a low ground pressure configuration to allow operation within the pond and stream channel.

Once the target soils and sediment have been removed and verified, the excavation will continue in the next remediation area and the placement of the geotextile, soil and stone cap (See Section 2.3.4) can proceed. Should the confirmatory samples indicate that the 25 ppm total PCB limit has not been achieved within the pond and brook or the Residential Direct Exposure Criteria for PCBs within the wetland area, additional excavation will be performed. Excavation will continue until all soil and sediment containing PCBs at concentrations in excess of 25 ppm within the pond and brook and the Residential Direct Exposure Criteria for PCBs within the wetland are removed.

Soil/Sediment Sampling and Analysis

Sampling and analysis of certain soils/sediments will be required to confirm horizontal and vertical limits, disposal and handling requirements. Soil and sediment confirmatory samples will be collected in accordance with the Field Sampling and Analysis Plan presented in Section 4.0. The excavated and staged soil and sediment will be sampled for disposal characterization. The soil and sediment disposal characterization samples will also be collected in accordance with the Field Sampling and Analysis Plan. All confirmatory and disposal characterization samples will be analyzed in accordance with the Quality Assurance Project Plan in Section 5.0.

Soil/Sediment Staging

During the soil and sediment removal activities the excavated soil and sediment may need to be temporarily relocated into staging areas adjacent to the excavation area for gravity dewatering and lime stabilization as detailed above. The staging areas will consist of a perimeter berm and will be lined with polyethylene and pavement to contain all soils and liquids. Soil and sediment placed within the staging areas shall be covered with a low permeability sheet to limit exposure to precipitation. All water within the staging areas will be collected in a pre-formed sump located at an intentionally defined low spot within the staging area(s). The collected water will be pumped to a settling tank, as necessary, within which solids will be separated. Water will be decanted from the settling tank, treated in an onsite water treatment system then discharged to the Town of East Hartford Water Pollution Control Facility or treated at the P&W Industrial Wastewater Treatment Facility and discharged to the Connecticut River. Sampling, as necessary to comply with the terms and conditions of the General Permit or the Temporary Authorization will be performed. Prior to initiating the discharge to the sanitary sewer, the treated water will be sampled to ensure that the PCB concentration is less than 1 µg/L and all other constituents comply with the terms and conditions of the general permit. Prior to initiating the discharge to the Connecticut River, the treated water will be sampled to ensure that the PCB concentration is less than 0.5 µg/L and all other constituents comply with the terms and conditions of the Temporary Authorization.

Stabilization

The excavated soil and sediment shall be staged for dewatering by gravity within a staging area in order to meet applicable requirements for disposal (i.e., no free liquids). It is anticipated that the soil and sediment will be further stabilized utilizing up to six percent lime by weight, only if necessary. Lime will be evenly incorporated into the excavated soil and sediment via mechanical mixing. This stabilization process is intended to facilitate the legal shipping of the contaminated material over-the-road to a permitted offsite disposal facility.

Off-Site Disposal

It is anticipated that all soil and sediment excavated as part of this project will be shipped to an offsite facility for disposal. The offsite disposal includes handling, storing, containerizing, transporting (including providing and preparing manifests, bills of lading, etc.) and disposing of excavated soil and sediment. The excavated soil and sediment will be transported via a licensed waste hauler to a permitted chemical or solid waste disposal facility dependant on the waste characterization. The estimated in-place volume of soil and sediment requiring offsite disposal is 12,500 cubic yards. A Table summarizing the off site disposal designation for the various waste streams anticipated follows.

Wastestream Description	Characterization Procedures	Disposal Designation
Soil/Sediment PCB>50ppm	In-situ soil sampling	RCRA/TSCA permitted Facility
Soil/Sediment PCB<50 ppm	In-situ soil sampling and stockpile characterization for disposal vendor	Subtitle D Landfill
Debris in an area of soil/sediment w/PCB >50 ppm	Assumed to be > 50 ppm PCB	RCRA/TSCA permitted facility
Debris in an area of soil/sediment w/PCB <50 ppm	In-situ soil sampling and disturbed debris sampling when in-situ is not practical	Subtitle D Landfill
Miscellaneous PPE, plastic sheeting, disposable sampling equipment, etc.	Assumed to be >50 ppm PCB	RCRA/TSCA permitted facility

Dust-Control

Included as Appendix D is a project-specific Dust Control Plan. This plan establishes the activities that will be performed to minimize the potential exposure to unacceptable levels of airborne contaminants during the work.

2.3.4 Pond/Stream Channel Cap, Engineered Control, Wetland Restoration

Following the excavation and demolition activities, Willow Brook and Willow Brook Pond will be restored. The planned restoration activities are described in detail below and depicted on Drawings 2-4 and 2-5 with related details and sections presented in Figures 2-6 through 2-8. The site restoration involves the installation of 3 types of caps/engineered controls over soil and sediments remaining following excavation and removal of those containing total PCBs at concentrations greater than 25 ppm. The cap details were derived based on the anticipated stream flow velocities and considered the ultimate use of the area as a combined wetland, pond, and stream channel. The base of each cap consists of a non-woven geotextile, a 9-inch layer of organic rich soil, and a non-woven geotextile. This layer is referred to below as an organic-rich layer. This organic-rich layer is included as a contingency to mitigate any potential for PCBs to migrate vertically upward through the proposed soil and rock cap. The caps are described below and are depicted on Figures 2-6 through 2-8.

- Within Willow Brook Pond, a 36-inch soil and stone cap is proposed (refer to Drawing 2-4 and Figure 2-6). The cap will consist of a 9-inch organic rich layer, 21 inches of process gravel, and a 6-inch layer of 4-inch stone. As the flow velocity in Willow Brook

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Pond is extremely low and is controlled by the dam at the outlet to the pond, the stone lining will provide adequate protection against erosion.

- Within Willow Brook (downstream of the dam), a 36-inch soil and stone cap is proposed (refer to Drawing 2-4 and Figure 2-7). The cap will consist of a 9-inch organic rich layer, a 15-inch layer of modified rip-rap and a 12-inch layer of cobbles, gravel and coarse sand. The 15-inch layer of modified rip-rap extends the width of the channel bottom and transitions into a 24-inch layer of intermediate rip-rap on the side slopes of the channel banks. The 24-inch layer of modified rip-rap extends up the channel banks to the elevation of the 10 year flood. The rip-rap channel lining has been designed to withstand the erosive forces anticipated in the stream channel following completion of the construction project.
- The area of the underground oil/water separator will be provided with a composite cap (refer to Drawing 2-4 and Figure 2-8). The composite cap will consist of a 40-mil flexible membrane liner, a geotextile drainage layer, 30-inches of granular backfill, and a 6-inch loam and seed layer.
- In addition to the above, the wetland north of Willow Brook will be restored by providing a soil and wetland sediment cap consisting of 24 inches of granular fill, and 12-inches of wetland soil. The wetland will be planted with native wetland plants (refer to Drawing 2-4 and Figure 2-9).

In response to a request by the Department of Environmental Protection (DEP) staff, the Willow Brook stream channel will be slightly modified between the dam that impounds Willow Brook Pond and Main Street to reduce the slope of the banks to control potential erosion and to modify the character of the channel bottom to create a low flow channel with pools and eddies. The limits of these improvements are shown on Drawing 2-5.

2.3.5 Site Restoration

Following the completion of the excavation and offsite disposal of contaminated soil and sediment, all areas disturbed by construction will be restored. The restoration of the waterway and wetland were described in the previous section (2.3.4). It is anticipated that restoration activities for area outside the waterway and wetland will consist of the installation of paved parking areas or grassed areas. Planned final site restoration is presented in Drawing 2-4.

The future site use options may consist of the following:

- Additional automobile and/or truck parking; and
- Relocation/rerouting of Willow Street to the northern portion of the property as indicated on Figure 2-10.

Following restoration activities, UTC/P&W will implement two institutional controls to ensure the long-term protectiveness of the proposed remedy. The institutional controls consist of 1) an Environmental Land Use Restriction to ensure the affected area will not be used for residential purposes and to prohibit excavation and 2) installation of a fence around the entire area to preclude access to Willow Brook and Willow Brook Pond (refer to Figure 2-5 and Drawing 2-4).

In the event that redevelopment of this area involves a bike path or roadway, the area directly beneath those uses will be remediated to a total PCB concentration of less than the Residential Direct Exposure Criteria. A release of the Environmental Land Use Restriction by the Commissioner of the Department of

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Environmental Protection would be necessary before any redevelopment activities are initiated. Such release would necessitate the preparation of a detailed remediation and restoration plan, which would be consistent with the future proposed use of the subject area or part thereof. Furthermore, appropriate barriers (i.e. fencing or railings) would be installed between the capped areas and the areas remediated to a concentration less than the Residential Direct Exposure Criteria.

2.3.6 Record Keeping and Reporting

The following records will be maintained during construction to document the remedial activities:

1. The delineation of the final horizontal and vertical limits of the soil and sediment removal activities;
2. A photographic record of construction progress;
3. Records of all quality assurance/quality control (QA/QC) testing performed;
4. A record of all field screening and confirmatory sampling and analytical results, including sampling methods, locations and depths, frequency, and analytical results;
5. Results of all waste disposal characterization samples of excavated materials;
6. Results of all samples of treated effluent from the temporary on-site wastewater treatment system;
7. A record of all daily activities; quantities of materials removed, generated, used, and disposed of; and document manpower, material, and equipment used;
8. A record of all materials and equipment delivered to the site; and
9. Copies of all hazardous waste manifests, non-hazardous waste bills of lading, and certificates of disposal for wastes generated during the project.

2.4 Post-Construction Activities

The following is a general description of the post-construction activities. It is anticipated that the post construction activities will include the preparation of a report documenting the remediation of the site and the implementation of a post-remediation groundwater monitoring program.

2.4.1 Post-Remediation Reports

A post remediation report will be prepared for submission to the appropriate regulatory agencies. The report will contain a detailed description of remediation activities, confirmatory samples, offsite disposal documentation, appropriate figures and drawings, and analytical data tables presenting results of confirmatory samples. The post remediation report will be prepared to provide a full accounting of all activities performed and documentation necessary to support the conclusion that the remedial activities met the objectives of this Remedial Action Work Plan. The report will be submitted to the CTDEP and EPA for review and ultimate approval. A separate report will be generated to satisfy the project closeout reporting requirements of the wetlands restoration efforts. The project closeout report is a likely condition of a permit or approval issued by the Army Corps of Engineers.

2.4.2 Post Remediation Groundwater Monitoring Program

Following completion of remedial activities, it will be necessary to perform post remediation groundwater monitoring of groundwater in the vicinity of Willow Brook and Willow Brook Pond. A Post-Remediation Groundwater Monitoring Program has been developed and submitted to the CTDEP and EPA. The Post-Remediation Groundwater Monitoring Program specifies groundwater monitoring wells

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to be sampled, field collection and analytical methods, quality assurance/quality control procedures, program duration, and reporting requirements. It is anticipated that post-remediation groundwater monitoring will be performed on a quarterly basis for a period of not less than two years.

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3.0 PROJECT SCHEDULE

The anticipated completion dates for major project activities are as follows:

- Permits from US Army Corps of Engineers, CTDEP and East Hartford July 2001
- Site Remediation Construction Period December 2001
- Site Restoration/Establishment of Vegetation June 2002
- Post Remediation Report, filing ELURs and Groundwater Monitoring Plan June 2002

A detailed project schedule is included as Figure 3-1.

4.0 FIELD SAMPLING AND ANALYSIS PLAN

4.1 Introduction

4.1.1 General

This plan addresses the field procedures, samples to be collected, sample type, sample location and the sample collection methods to be used during implementation of the remedial activities outlined in the RAWP. The Quality Assurance Project plan (QAPP), is presented in Section 5.0.

4.1.2 Objectives of the Sampling and Analysis Plan

The overall objective of the sampling and analysis program is to provide analytical data that verify the achievement of the remediation goals for the site. The sampling program has been developed in consideration of the requirements presented in 40 CFR Part 761 Section 761.61 (c), 40 CFR Part 761 Subpart O, and the documents entitled *Verification of PCB Spill Cleanup By Sampling and Analysis*, EPA August 1985 and *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup*, EPA May 1986. The objective of this risk managed remediation program is to remove PCB-impacted soil and sediment exhibiting concentrations in excess of 25 ppm and place a 3-foot cap over the residual contamination areas (i.e., those areas that exhibit PCB concentrations less than 25 ppm). The proposed caps were described in previous sections. The exceptions to this approach are the wetland downgradient of the dam will where excavation of soil at concentrations greater than the Residential Direct Exposure Criteria for PCBs will be performed and the area backfilled and planted to restore the wetland, and the footprint of the process water facility where soil will be remediated to meet the Residential Direct Exposure Criteria for PCBs for soils within 4-feet of the final grade, the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for soils above the seasonal high water table, prior to the placement of backfill.

Based on the objectives of the remediation program, the following specific objectives have been established for the sampling and analysis program:

- Confirm that PCB concentrations remaining in soil/sediment at the limits of the excavation are consistent with the Remedial Action (RA) objectives; and
- Determine the handling and disposal requirements for the soil/sediment and miscellaneous materials generated during implementation of the RA.

4.1.3 Overview of the Sampling and Analysis Program

Analytical results associated with samples collected as part of the RA activities will be used to document that the objectives of the RA have been satisfied. Samples that will be collected as part of the RA will consist of the following:

- Post-excavation soil/sediment samples to confirm the successful implementation of the RA and document residual contamination concentrations;
- Post PCB excavation soil sampling to confirm the limits of soil requiring remediation pursuant to the RSR (as a result of other constituent concentrations) in the vicinity of the former oil/water separator, process water facility and the wetland area;

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- Concrete disposal characterization samples;
- Soil/sediment disposal characterization samples for verification of constituent concentrations; and
- Miscellaneous material samples for the assessment of disposal options and/or treatment performance (e.g., the temporary wastewater treatment system) associated with the implementation of the RA.

The location of the characterization samples performed and PCB isoconcentration contours are shown on Figures 1-2 and 1-3 for Willow Brook and Willow Brook Pond, respectively. The proposed layout of the confirmatory composite sample grid to be employed within the project limits is shown schematically in Figure 4-1. The proposed layout for the confirmatory sampling is presented on Drawing 4-1. In addition, disposal characterization samples will be collected from excavated materials associated with the RA.

4.2 Remedial Action Field Sampling

4.2.1 General

Details associated with implementing the Field Sampling Program (FSP) are presented in this section. The following information concerning the FSP is also provided:

- Proposed sample grid, sample identification numbers, and sample type;
- Procedures for sampling and for measuring field parameters; and
- A summary of the data to be generated from each sampling effort, including field and analytical parameters.

Detailed information regarding the RA field sampling including the number/type of environmental samples and quality control samples to be collected, sample intervals, analytical parameters, sample containers, preservation, and holding times are presented in tables located at the end of this section. A description of these tables is provided on the following page.

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Table No.	Title	Contents
4-1	Confirmatory Sample Summary	Presents the sample media, anticipated number of samples to be collected from the excavations, and the laboratory analytical methods.
4-2	Detailed Confirmatory Sampling Summary by Remediation Area	Presents the number and type of confirmatory samples to be collected from remediation areas at the site.
4-3	Extraction Method Summary	Presents the analytical extraction method, by analysis method, to be utilized for each type of solid sample media anticipated to be collected during the implementation of the remedial action.
4-4	Quality Control Analyses Summary	Indicates the number and type of quality assurance/quality control (QA/QC) samples, which will be collected during the implementation of the remedial action.
4-5	Required Containers, Preservatives, and Analysis Holding Times for Solid, Aqueous, and Vapor Samples	Indicates the appropriate sample containers, preservation methods, and holding times for the samples to be collected.

All sampling activities will be performed in accordance with the Loureiro Engineering Associates, Inc. Standard Operating Procedures provided in Appendix B.

4.2.2 Post-Excavation Confirmatory Sampling

Post-excavation confirmatory sampling of soil/sediment will be conducted in the areas to be excavated (Drawing 2-3) to confirm that residual PCB concentrations do not exceed the RA objectives at the limits of the excavations (25 ppm PCBs in all areas to be capped, GB Pollutant Mobility Criteria for all soils above the seasonal high water table and the Commercial/Industrial Direct Exposure Criteria in inaccessible soil locations within and immediately adjacent to the process water buildings, and the Residential Direct Exposure Criteria in the wetland area to the north of the stream channel). The proposed layout for the confirmatory sampling is presented on Drawing 4-1. Confirmatory soil sampling will be performed throughout the project as necessary to document the adequacy of the remedial measures as proposed.

PCB Confirmatory Soil Sampling – Engineered Control Areas

The approach for the verification of remediation in engineered control areas at the site will consist of the collection of composite soil samples from the bottom and sidewalls of the excavation. Bottom composite sampling will be performed at a rate of one sample representing a 1,600 square foot area (equating to a 20 by 20-foot grid spacing) and a rate of one composite sample representing a 320 square foot area of sidewall excavation. This approach is being proposed based on the lack of variability and low degree of contamination at the depths of excavation proposed to achieve the RA objectives the degree of lateral variability observed in the existing dataset. The actual number of composite samples to be collected in a given remediation area will be determined based on the lateral limits of the area upon final excavation. A schematic layout of composite sample locations within engineered control areas is provided as Drawing 4-1. A summary of the confirmatory sampling to be performed for the project is provided as Table 4-2.

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To confirm the vertical extent of remediation, post-excavation confirmatory soil/sediment samples for PCBs will be collected from the bottom of the excavated areas which will be located beneath the engineered controls within Willow Brook, Willow Brook Pond, and the oil-water separator area as defined above at a frequency of one sample per 400 square feet, which equates to a 20-foot grid spacing. Grab samples will be obtained on each grid node. A maximum of four grab samples from adjacent grid nodes will be composited into one sample in the field for PCB analysis in the laboratory. This analysis will represent the respective 1,600 +/- square foot area as shown in Figure 4-1. The sampling points will proceed in every direction to the extent sufficient to result in a comprehensive two-dimensional grid completely overlaying the bottom of the excavation area. Judgmental samples would be added as appropriate based upon field observations (i.e. discoloration or stratification) and as needed to adequately represent the floor area of each remediation area. Based on the available analytical data and related proposed limits of the remedial excavation, Drawing 4-1 (Potential Confirmatory Sample Locations) was prepared to demonstrate the expected layout of the bottom composite sampling grid. As noted, additional judgmental samples will be collected, as appropriate. Due to the irregular shape of remediation areas within the limits of the project and the coverage provided by the proposed grid layout, should remediation be completed to the limits shown on Drawing 4-1, each composite bottom sample would be representative of 1,200 square feet of excavation area. This is an approximately 25 percent greater sampling density than the proposed rate of one sample per 1,600 square feet. It is anticipated that during implementation of remediation, a similar sampling density to that depicted on Drawing 4-1 and Table 4-2 will be realized.

The grid spacing for the analysis of the vertical extent of remediation in engineered control areas within Willow Brook and Willow Brook Pond is appropriate as remediation within these areas of the site will result in the excavation of nearly all sediment and the contaminant delineation investigation performed prior to remediation indicate that PCB contamination is coincident with the sediment and the underlying sand material was shown to contain PCBs at concentrations significantly lower than 25 ppm. In fact, the PCB concentrations in the underlying sand approach 1 ppm. The grid spacing for the analysis of the vertical extent of remediation in the vicinity of the oil/water separator area is also appropriate. To complete the removal of the oil/water separator (the source of contamination in this area) and to achieve a 25-ppm goal, the excavation activities will result in the removal of nearly all soil to a depth of the bottom of the former structure. The contaminant delineation investigation performed prior to remediation indicated that PCB concentrations at depths beneath the separator are significantly lower than 25 ppm.

In order to document the adequacy of the lateral extent of the remediation within the engineered control areas, composite samples will be collected from the vertical sidewall of the excavations at a rate of not less than 1 composite sample per 320 square feet of sidewall. Each composite sample will be comprised of not more than four individual aliquot samples. Individual aliquot samples will be collected at a rate of one sample per 4-vertical feet every 20 linear feet along the sidewall. This sampling pattern will be enhanced with judgmental samples as needed based on field observations. The sampling density for sidewall sampling is greater than the sampling density proposed for assessing vertical extent of remediation in the engineered control areas. The rationale for the performance of composite samples for sidewalls of excavations (rather than a combined sidewall and bottom composite sampling scheme) is based on the fact that soil and sediment samples collected during the performance of contaminant delineation investigations indicated a degree of variability in comparison to a low degree of variability in samples collected from beneath the bottom sediments. This approach will yield data adequate to assess the lateral limits of excavation as sidewall samples will be taken from undisturbed sediments and soils along the lateral limits of each excavation area and will not be combined with aliquots from the bottom of excavations. Based on lateral limits defined for each excavation area, the proposed sampling approach will adequately address potential variability in sediment concentrations to ensure that the RA objective of 25-ppm for these areas of the site will be met. As shown in Table 4-2, though sampling is to be

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performed at a rate of one sample per 320 square feet of sidewall of excavation, should excavation be performed to the limits shown on Drawing 4-1, the size and irregular shape of remediation areas would result in each sidewall composite sample being representative of 270 square feet of excavation area. A 15 percent increase in sampling density. As with bottom composite sampling, it is anticipated that similar density will be encountered during implementation of remediation at the site.

Evaluation of the composite data for PCBs would be based upon a direct comparison of the sample data to the 25 ppm criteria. More specifically, any result for a composite sample below 25 ppm in a 25-ppm target area located beneath the engineered control would result in the conclusion that remediation in those areas has been completed.

PCB Confirmatory Soil Sampling – Non-Engineered Control Areas

The following is a summary of the non-engineered control areas at the site:

- The wetland area which will be remediated to less than the Residential Direct Exposure Criteria for PCBs and less than the Commercial/Industrial Direct Exposure Criteria for other constituents;
- A small area in the vicinity of WT-SB-132 which will be remediated to meet the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for all constituents in soils above the seasonal high water table as previously described; and
- The footprint of the process water facility which will be remediated to meet the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for all constituents in soils above the seasonal high water table.

The approach for the verification of remediation in non-engineered control areas at the site will consist of the collection of both composite and grab soil samples from the bottom and sidewalls of the excavation. Bottom composite sampling will be performed at a rate of one sample per 1,600 square feet of excavation (20 by 20-foot grid spacing). As the non-engineered control areas must also be remediated in a manner consistent with the RSR, individual grab samples will also be collected from the center of each of the 20 by 20-foot grid squares utilized for bottom composite sampling (a rate of one sample per 1,600 square feet of excavation area). In order to document the adequacy of the lateral extent of the remediation within these areas, soil grab samples will be obtained from the sidewalls of the excavations at varying depths at a rate of not less than 1-sample per 320 square feet of excavation sidewall. This sampling pattern will be enhanced with judgmental samples as needed based on field observations (i.e. stratification, discoloration, etc.).

This approach is being proposed based on the lack of variability and degree of contamination at the depths of excavation proposed to achieve the RA objectives and the degree of lateral variability observed in the existing dataset.

Evaluation of grab sample data for PCBs in an area to be remediated to the RDEC would be based on a comparison of the grab sample data to the RDEC. Evaluation of grab sample data for PCBs in an area to be remediated to the IDEC (soils at depths greater than 4 feet in the footprint of the former process water facility) would be based on a comparison of the grab sample data to the IDEC. This determination will also include consideration of composite data as well. Evaluation of the composite data for PCBs would be based upon a direct comparison of the sample data to the RDEC. More specifically, any result for a composite sample must be below the numeric RDEC in an area to be remediated to the RDEC and any

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result for a composite sample must be below the IDEC in an area to be remediated to the IDEC. However, the grab sample data will govern the overall determination of compliance.

Confirmatory Soil Sampling for Constituents Other than PCBs

As defined by the available analytical data, there are other constituents of concern that are noted in soil and sediment within the project area. These other constituents include metals, VOCs, SVOCs, TPH and cyanide. The remediation is designed to address these constituents as well as PCBs. Remediation of other constituents of concern found in the remediation areas will be completed in accordance with the RSR as follows:

- In all areas to be provided with an engineered control, no numeric goals for other constituents apply as the areas are being addressed in accordance with the variance provision in the RSR thereby allowing soils exceeding the tabular criteria to be left in place (no sampling proposed);
- The wetland area which will be remediated to less than the Residential Direct Exposure Criteria for PCBs and less than the Commercial/Industrial Direct Exposure Criteria for other constituents;
- A small area in the vicinity of WT-SB-132 which will be remediated to meet the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for all constituents in soils above the seasonal high water table as previously described; and
- The footprint of the process water facility which will be remediated to meet the Commercial/Industrial Direct Exposure Criteria for PCBs for soils located in inaccessible locations and the GB Pollutant Mobility Criteria for all constituents in soils above the seasonal high water table.

As discussed earlier in this section, the lateral extent of remediation in two specific areas of the site will need to be evaluated (in the vicinity of the former oil/water separator and within the wetland area). In order to document the adequacy of the lateral extent of the remediation within the wetland area, soil grab samples will be obtained from the sidewalls of the excavations at a rate of one grab sample per 320 square feet of sidewall of excavation. This sampling pattern will be enhanced with judgmental samples as needed based on field observations. This pattern would be implemented on the northern, eastern and western sidewalls of the wetland remediation area. Since the wetland area will be restored without a cap, floor sampling for constituents of concern other than PCBs will be necessary. Floor sampling will be accomplished by obtaining one grab sample at the center point of the four adjacent grab sample locations defined for PCB sampling. This analysis will represent the respective 1,600 +/- square foot area as shown in Figure 4-1.

For the oil/water separator area, the excavation will proceed until the results of the previously described PCB confirmatory sampling verify removal of all soil and sediment containing greater than 25 ppm PCBs. The limits of the composite cap to be installed over this area will be defined through additional soil sampling and analysis discussed in Section 2.0. The initial sampling locations are shown on Drawing 4-1. Additional soil borings would be added, as necessary, to delineate the three-dimensional extent of soils impacted by constituents other than PCBs (i.e. metals, cyanide, VOCs, SVOCs, and TPH). It is anticipated that soils requiring remediation for constituents other than PCBs extends beyond the lateral limits of soil impacted by greater than 25 ppm PCBs. As a result, following excavation of soils greater than 25 ppm PCBs, non-RCRA soils from the upper three-feet outside the lateral limits of the PCB excavation, but within the limits defined as requiring remediation for other constituents pursuant to the RSRs, will be stripped and used to backfill the PCB excavation. Confirmatory sidewall grab sampling as

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described above for the wetland area will be implemented to ensure all soils requiring remediation pursuant to the RSR will be located beneath the composite cap.

The analytical data derived from these analyses for other constituents would be compared to the appropriate criteria presented in the RSR. As noted above, exceedances would be addressed by extension of the cap or further remediation, as appropriate.

Sample Collection

Procedures for collecting post-excavation PCB confirmatory soil/sediment composite samples are presented as follows:

- Soil/sediment will be collected from each of the discrete sampling locations through the use of a calibrated disposable syringe. One syringe will be used for each composite sample unless the integrity of the syringe is questionable or it becomes clogged. The individual grab samples will be used to form a single composite sample in the field.
- Each aliquot will be examined for the presence or likelihood of free liquid. If these features appear, the aliquot(s) will be allowed to "rest" so that any free water can be decanted prior to compositing. In such cases, dedicated syringes will be used to facilitate timely completion of the sampling task.
- The aliquots will be composited and mixed thoroughly in the laboratory-supplied glassware.
- At the laboratory, a final sample, of sufficient weight and volume will be collected from the composite and then extracted and analyzed for the PCBs in accordance with the EPA methods described in Tables 4-1 and 4-3.
- A second portion of the sample will be weighed out at the same time as the portion to be used for analytical determination. This portion will be weighed, oven-dried and used to calculate the percent dry weight of the sample. The oven-dried aliquot will not be extracted or used for analytical determination.

Procedures for collecting vertical and lateral limit confirmatory grab soil samples (constituents other than PCBs) are presented as follows:

- Soil will be collected from each of the discrete sampling locations. The individual grab samples will not be used to form a composite sample.
- A sample, of sufficient weight and volume will be obtained from the sample container, extracted and analyzed to represent the post-excavated confirmatory soil present.
- Samples for VOC analysis will be collected in accordance with SW-846 Method 5035.
- A second portion of the sample will be weighed out at the same time as the portion to be used for analytical determination. This portion will be weighed, oven-dried and used to calculate the percent dry weight of the sample. The oven-dried aliquot will not be extracted or used for analytical determination.

Soil/sediment samples shall be collected using disposable sampling equipment or decontaminated spatulas, split-spoon samplers, augers or an equivalent. All disposable components of a sampling device will be disposed of prior to sample collection and all fixed components of a sampling device will be decontaminated prior to sample collection. The materials and procedures to collect post-excavation confirmatory soil/sediment samples are presented below.

- Appropriate health and safety equipment;

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- Plastic sheeting;
- Tape measure (50 feet or greater);
- Appropriate soil sample containers;
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials;
- Field forms and labels;
- Chain-of-custody forms; and
- Site map with post-excavation confirmatory soil/sediment locations.

Each component of the sampling device will be decontaminated or replaced with a new, dedicated, or disposable component prior to collecting soil/sediment samples for laboratory analysis. The sampling equipment will be decontaminated as previously discussed.

A portion of each confirmatory soil sample will be used for visual and hand texture characterization as necessary to describe the material sampled in the field sampling forms. In addition, field analysis will be conducted to determine if PCB concentrations are above or below the RA objective of 25 ppm. The field analysis will be performed using screening tests, as for example, rapid immunoassay screen test kits. The PCB field test kits are a semi-quantitative screening method that determines whether the total PCB concentration is above or below the specified threshold values by comparison with a standard. Rapid immunoassay screen tests will not be used to determine final compliance with the RA objectives, rather they will be used as a means to direct the need for further excavation prior to embarking on final confirmatory sampling and analysis at a fixed laboratory in accordance with the procedures outlined above. The manufacturer will provide standard operating procedures for PCB field test kits. Final confirmatory samples will be submitted to the laboratory for analysis for PCBs (USEPA SW-846 Method 8082 revised Jan. 1998).

QA/QC soil/sediment samples will also be collected as described in Section 4.5.2 and in the QAPP presented in Section 5.0. Trip blanks, equipment blanks, duplicate samples and performance evaluation samples will be submitted for analysis. Table 4-1 presents the number of soil/sediment samples to be collected, and Table 4-4 presents the associated QA/QC soil sampling frequencies. Samples will be placed in appropriate laboratory supplied sample containers, preserved as described in Section 4.4.1, and labeled as described in Section 4.4.2. The samples will be handled, packaged, and shipped under appropriate chain-of-custody procedures as presented in Section 4.4.3.

4.2.3 Disposal Characterization Sampling

Contaminated soil and sediment will be characterized for disposal based on the "as-found" concentration of PCBs in accordance with 40 CFR 761.61. This data will establish the basis for segregation within the staging areas. Additional analysis will be performed on stockpile grab samples as needed to satisfy the disposal vendor. Additional analytes beyond PCBs may include metals, VOCs, SVOCs, pesticides and herbicides, TPH, or cyanide as appropriate for thorough characterization. The waste will be disposed of based upon the more restrictive analytical data regardless of the as-found concentrations (e.g. if in-situ characterization documents < 50 ppm PCBs and the stockpile data suggests > 50 ppm, the waste disposal profile used for this particular load would be based on the stockpile data). Stockpile analytical data would not be used to reduce any disposal restrictions on the material.

A minimum of two and a maximum of four separate waste streams are expected. The minimum two waste streams are PCB remediation waste (PCBs > 50 mg/kg) and PCB remediation waste (PCBs < 50 mg/kg). The additional two waste streams would include the above minimum two but with the addition

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of other underlying hazardous constituents. Supplemental analysis (for PCBs as well as other constituents of concern) will be performed for disposal vendor satisfaction and for disposal characterization of the concrete debris from demolition of the process water facility and the former oil/water separator. Supplemental analysis for disposal vendor satisfaction will be performed from stockpile grab samples using a random node sampling technique. Disposal characterization sampling of concrete debris will be performed at a rate of approximately 1 sample per 500 tons of concrete debris or at a more frequent rate as directed by the disposal vendor.

4.2.4 Miscellaneous Sampling

In addition to the sampling activities described above, additional sampling may be performed to determine handling and disposal requirements. These samples may include effluent samples from the temporary wastewater treatment system and debris from the demolition of the existing process water facility. A description of the sampling and analysis to be conducted for each of these materials is presented below.

Effluent Samples from the Temporary Wastewater Treatment System

Surface water or groundwater that enters the active remedial excavations and water generated from soil/sediment dewatering activities will be pumped to on-site storage tanks and treated on site at a temporary wastewater treatment system. During normal operation of the temporary wastewater treatment system, effluent samples will be collected and analyzed for specific parameters as required by the general permit or Temporary Authorization. Effluent samples will be collected and analyzed in accordance to the frequency specified by the general permit or Temporary Authorization to confirm that discharge permit limits are achieved.

Demolition of the Existing Process Water Facility

As part of the RA, the existing process water facility will be demolished. All debris in contact with PCB contaminated soil generated by the demolition activities and any durable porous materials in contact with PCB contaminated soil to be left in place will be sampled in-situ where physically practiced for characterization. The as-found PCB concentrations will be used to define the waste disposal profile or decontamination procedures necessary.

4.3 Sample Designation System

4.3.1 Sample Codes

A six-digit designation code and sample date will provide each sample with a unique sample identification number. This alphanumeric system will apply to all samples collected and submitted to the designated laboratory for analysis. The designation codes that will be used for the samples collected, as part of the RA, are presented on the following page.

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Sample Type	Sample Location Designation
Confirmatory Soil/Sediment Samples	<ul style="list-style-type: none">• A prefix indicating that the sample was collected in the Waste Treatment area (WT-)• A designation (CS) indicating that the sample is a confirmatory sample;• A consecutive number indicating the sample collected.
Disposal Characterization Soil/Sediment Sample	<ul style="list-style-type: none">• A prefix indicating that the sample was collected in the Waste Treatment area (WT-)• A designation (DC-) indicating that the sample is a disposal characterization sample;• A consecutive number indicating the sample collected.
Temporary Wastewater Treatment System Effluent Samples	<ul style="list-style-type: none">• A prefix indicating that the sample was collected in the Waste Treatment area (WT-)• Samples of the effluent water from the treatment system will contain the designation (EW) followed by a consecutive sample number.

Blind sample numbers will be assigned to the samples submitted to the laboratory for QA/QC purposes. The blind sample numbers will be associated with the sample location designations only in the field forms.

4.4 Sample Handling and Documentation

4.4.1 Sample Containers and Preservation

Appropriate sample containers, preservation methods, and laboratory holding times for samples collected as part of the RA are shown in Table 4-5. The analytical laboratory will supply appropriate sample containers, sample labels, and preservatives.

An example of a sample label, custody seal, field sampling record and chain-of-custody form are included in Figures 4-2 through 4-5, respectively.

4.4.2 Packing, Handling, and Shipping Requirements

Sample custody seals and packing materials for filled sample containers will also be provided by the analytical laboratory. The filled, labeled, and sealed containers will be placed in a cooler with ice and packed to eliminate the possibility of container breakage.

All samples will be packaged by the field personnel and transported as low concentration environmental samples. The packaged samples will be shipped either by carrier or hand delivered to the laboratory within 36 hours of sample collection.

4.4.3 Documentation

Field personnel will provide documentation for all aspects of field sampling, field analysis, and sample chain-of-custody. This documentation constitutes a record, which allows reconstruction of all field events to aid in the data review and interpretation process. All documents, records, and information relating to the performance of the fieldwork will be retained in the project file.

Various forms of documentation to be maintained throughout the RA include:

- Daily Production Documentation – Daily field forms containing a record of all field sampling activities.
- Sampling Information – Detailed notes will be made concerning the sample location, physical observations, sample depths, and weather conditions.
- Chain-of-Custody – Chain-of-custody forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. Chain-of-custody forms will be filled out at each sampling site, at a group of sampling sites, or at the end of each day of sampling by one of the field personnel designated to be responsible for sample custody.
- Field Equipment Calibration, and Maintenance Logs – To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for each piece of field equipment.

4.4.4 Electronic Database

All data including field and analytical data collected will be maintained in a site-specific electronic database. The database already contains all characterization data obtained during the Willow Brook and Willow Brook Pond investigations to date. All data entered in the database will be verified for accuracy.

4.5 Management of Sampling-Related Materials and Wastes

The handling of sampling related materials and wastes is discussed below.

4.5.1 Disposable Equipment and Debris

Disposable equipment and debris, such as health and safety equipment, plastic sheeting, sampling equipment, and other equipment and/or sampling debris not reused during the RA will be collected in plastic bags during sampling and disposed of as PCB remediation waste (PCB >50ppm) and would be included in the soil loads in accordance with the miscellaneous H&S waste provisions permitted under the standard disposal profile.

4.5.2 Decontamination Rinsate

Decontamination rinsate will be containerized at a controlled, centralized location in an appropriate temporary storage container or in labeled 55-gallon drums. Upon completion of the field sampling activities, the rinsate will be treated to comply with the maximum allowable concentrations stipulated in the General Permit for the Discharge of Groundwater Remediation Wastewater prior to discharge to the sanitary sewer.

4.6 Field Quality Assurance/Quality Control

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This section summarizes the Quality Assurance/Quality Control (QA/QC) requirements for sampling activities associated with the RA at the site. Table 5-5 includes accuracy and precision data for field instrumentation.

4.6.1 Field Instrument Calibration and Preventative Maintenance

Field personnel will document the calibration and maintenance of all applicable field equipment in the appropriate field forms. Table 5-4 details the frequency at which field instruments will be calibrated.

4.6.2 QA/QC Sample Collection

QA/QC samples will be collected at a frequency of one every 20 samples and submitted to the laboratory for analysis. The number of QA/QC field samples to be collected is provided in Table 4-4. The type of QA/QC samples to be collected during the RA includes trip blanks, equipment blanks, duplicate samples, aqueous performance evaluation (PE) samples, and matrix spike/matrix spike duplicate (MS/MSD) samples. Guidance on the collection of the QA/QC samples is presented below:

Trip Blanks

Trip blanks will be collected at a frequency of one every 20 samples or one per cooler per day to ensure that the samples are not contaminated by VOCs while in transit to the laboratory. The trip blanks will be prepared by the laboratory and delivered along with the sample glassware. No trip blanks will be collected in sample batches that do not include analysis for VOCs.

Equipment Blanks

Equipment blanks are collected as a check that the decontamination procedure has been adequately performed and that cross-contamination of samples will not occur due to the sampling equipment. Equipment blanks will be prepared in the field by pouring laboratory supplied analyte-free water into or over decontaminated sampling equipment and then directly into the laboratory supplied sample bottles. One equipment blank will be collected for each representative type of equipment used (i.e., spoons, bowls, split-spoon sampler, etc.) for every 20 samples collected and/or at a minimum of once per week.

Field Duplicate Samples

Field duplicates will be submitted at the rate of one for every twenty samples, per matrix. Field duplicates are collected as collocated samples. The soil samples will be thoroughly mixed and homogenized and transferred to the appropriate sample containers. If standing water is noted on the soil sample, the LEA field technician will attempt to dry the sediment by placing soils on an absorbent pad to wick away water from the sample. The field technician will also attempt to prevent larger grained particles (gravel and cobbles) from being included in the sample to promote homogeneity. Following dewatering the sample, the soil samples will be placed directly into appropriate sample glass jars. Soil samples will then be placed into sample coolers. Field duplicates provide precision information regarding homogeneity and distribution of the contaminants; they measure the bias of sub-sampling.

Duplicate samples will be sent for laboratory analysis to evaluate the reproducibility of the sampling technique used.

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Performance Evaluation Samples

Performance evaluation samples will be sent for laboratory analysis to ensure that environmental data collection results in the delivery of analytical data of known and documented quality, suitable for its use. Aqueous PE samples for each suite of analytes (PCBs, metals, VOCs, SVOCs, TPH, and cyanide as applicable) will be analyzed at a frequency of one every 20 samples analyzed. The analytical results of the PE samples will be evaluated following USEPA Region I Performance Evaluation Sample Guidance – Attachment H, July 1996. The PE samples will be counted as field samples in the 20-sample SDG total.

5.0 QUALITY ASSURANCE PROJECT PLAN

5.1 Introduction

The QAPP discusses objectives and QA/QC protocols to be used to achieve the Data Quality Objectives (DQOs) for the delineation and removal of selected soils and sediments associated with the remediation of Polychlorinated Biphenyl (PCB) contaminated sediment within Willow Brook and Willow Brook Pond at the United Technologies Corporation (UTC), Pratt & Whitney (P&W) manufacturing facility in East Hartford, Connecticut (Site). The remediation approach consists of the excavation and offsite disposal of soil and sediment from within and immediately surrounding Willow Brook and Willow Brook Pond that contains PCBs at concentrations greater than 25 milligrams per kilogram (mg/kg or parts per million (ppm)).

5.1.1 General

This Quality Assurance Project Plan (QAPP) has been prepared with reference to the guidance as presented in the *Region I, EPA-New England Compendium of Quality Assurance Project Plan Requirements and Guidance* document and attachment A to this document *Region I, EPA New England Quality Assurance Project Plan Manual (QAPP Manual)*. Analytical methods and procedures as presented in SW-846 will be used during implementation of the Remedial Action (RA), as outlined in the Remedial Action Work Plan, (RAWP).

5.1.2 Objectives of the Quality Assurance Project Plan

Quality assurance objectives are generally defined in terms Data Quality Indicators (DQIs formally know as PARCCS parameters). DQIs are comprised of five parameters: precision, accuracy, representativeness, completeness, and comparability. These parameters are defined in sections 5.3.6 through 5.3.10 of this QAPP. The measurement performance criteria of the for confirmatory sampling data associated with the DQIs will be evaluated during the Tier II data validation which will be performed in accordance with the Region 1, EPA New England Functional Guidelines for Data Validation .

The objective of the QAPP is to present the quality assurance/quality control (QA/QC) procedures to be implemented during the RA. The QAPP ensures that the data generated is of sufficient quality and quantity to allow confirmation that the RA objectives for the site are achieved. The sampling objectives of the QAPP are as follows:

- Confirm that residual PCB soil/sediment concentrations (at the horizontal and vertical limits of the excavation) satisfy the objectives of the RA;
- Determine handling and disposal requirements for the soil/sediments generated during the RA; and,
- Determine handling and disposal requirements for the miscellaneous materials generated during the RA.

5.1.3 Remedial Action Data Quality Objectives

To obtain data necessary to meet the objectives previously stated, the following categories of field sampling will be conducted as part of the RA:

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- Post-excavation confirmatory soil/sediment samples to confirm the successful implementation of the RA and document residual contamination concentrations.
- Soil/sediment disposal characterization samples for assessment of disposal options; and
- Miscellaneous material samples for the assessment of disposal options and/or treatment performance (e.g., the temporary wastewater treatment system) associated with the implementation of the RA.

Preliminary Data Quality Objectives (DQOs) were identified to ensure that the data generated during field sampling will be of adequate quality and sufficient quantity to form a sound basis for decision making purposes relative to the above objectives. DQOs have been specified for each data collection activity.

DQO summaries for the RA activities are presented in the following section. The summary consists of stated DQOs relative to the following items:

- Data Uses;
- Data Types;
- Data Quality;
- Data Quantity;
- Sampling and Analytical Methods; and
- Data Precision, Accuracy, Representativeness, Completeness, and Comparability Parameters (DQIs formally known as PARCCS).

The categories of analytical data discussed in the following sections with regard to data quality are defined as follows:

Screening Data: Screening data will be used to provide a quick assessment of site characteristics or conditions. This objective for data quality is available for data collection activities that involve rapid, non-rigorous methods of analysis and quality assurance. This includes field measurements such as immunoassay test kit results. This data will be reviewed and verified for accuracy and completeness as the field forms are processed by the LEA task manager.

Disposal Characterization Data: This includes all disposal characterization data, debris sampling and routine wastewater sampling prior to discharge. This data will be generated by a state-certified laboratory using EPA-approved analytical methods. The data will be reviewed for accuracy and data verification will be performed. This data will also be entered in the site-specific database. No data validation will be performed.

Confirmatory Data: Confirmatory data will be generated from a state-certified analytical laboratory using EPA-approved analytical methods. The data will be reviewed for accuracy and data verification will be performed. A Tier II data validation will be performed on all confirmatory data obtained in accordance with EPA Region I data validation guidelines. This data will also be entered in the site-specific database.

5.1.4 Post-Excavation Confirmatory Soil/Sediment Sampling

Data Uses

Post-excavation confirmatory soil/sediment sampling will be conducted to confirm that residual concentrations of PCBs, metals, VOCs, SVOCs, TPH, and cyanide (if applicable) present at the limits of excavations in the excavated areas are below the RA objectives.

Data Types

Confirmatory soil/sediment sampling will include the collection and analysis of samples for PCBs, metals, VOCs, SVOCs, TPH, and cyanide (if applicable). Table 4-1 of the QAPP presents the anticipated number of confirmatory soil/sediment samples to be collected and the laboratory analysis to be performed. Visual observation, and field screening of soil/sediment samples using PCB immunoassay field test kits will also be conducted to select soil/sediment samples for laboratory analysis.

Data Quality

Sample analysis for PCBs metals, VOCs, SVOCs, and cyanide (if applicable) will be conducted in accordance with the methods referenced in the USEPA document SW-846. TPH analysis will be conducted by SW-846 Method 418.1. In addition, field screening of soil/sediment samples will be performed using PCB immunoassay field test kits in accordance with the Standard Operating Procedures (SOPs) which have been provided by the manufacturer and are included in Appendix B. The results will be presented using a Tier II laboratory data quality package and final electronic deliverables.

QA/QC samples will be performed for the confirmatory soil/sediment samples collected. The number and type of QA/QC soil/sediment samples to be analyzed are summarized in Table 4-4.

Data Quantity

The location, number and type of analysis of post-excavation confirmatory soil/sediment samples to be analyzed from the excavation area will be determined based on a 20-ft grid as discussed in the previous section. The samples collected will be analyzed for PCBs, metals, VOCs, SVOCs, and cyanide in select areas.

Sampling and Analysis Methods

The Field Sampling Plan contains a description of the post-excavation confirmatory, disposal characterization and additional miscellaneous sampling procedures to be employed during the RA. The recommended project-specific laboratory analytical methods and reporting limits are listed in Table 5-1 of this QAPP. The final project-specific laboratory analytical methods and reporting limits will be supplied by the selected analytical laboratory prior to commencing work.

Precision And Accuracy Quality Control Limits

Recommended precision and accuracy quality control limits for chemical constituents that are used during data review to assess analytical performance, are included in Tables 5-2 and 5-3. Final precision and accuracy quality control limits will be generated by the selected analytical laboratory though internal control limits. These limits will be provided to LEA prior to commencing work. Data comparability will

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be achieved through the use of standard CTDEP/USEPA approved methods. Data completeness will be assessed at the conclusion of the RA.

5.1.5 Disposal Characterization Sampling

Data Uses

Disposal characterization sampling will be conducted to determine handling requirements for soil/sediment and debris excavated during the RA.

Data Type

The disposal characterization sampling will include the collection of soil/sediment and porous media samples. Sampling will be conducted on these materials in their in-situ condition for waste characterization. Samples will be analyzed by a laboratory in accordance with the provisions of this plan. Immunoassay field testing may be used to supplement the laboratory data when segregating >50 ppm PCB remediation waste from < 50 ppm PCB remediation waste.

Data Quality

Laboratory analysis for PCBs and other constituents of concern will be performed in accordance with the methods referenced in USEPA SW 846. The results will be presented using a standard laboratory report format and final electronic deliverables. Field screening of soil/sediment samples may be performed using field test kits in accordance with SOPs provided by the manufacturer.

Data Quantity

Typically, one composite disposal characterization sample will be collected for every 500 CY of soil/sediment removed from a RA excavation area as directed by LEA. LEA may elect to perform disposal characterization sampling at an alternate frequency based on review of previous investigation data to aid in the evaluation of disposal options. QA/QC disposal characterization samples will not be submitted for laboratory analysis.

Sampling and Analytical Methods

The Field Sampling Plan presents a description of the disposal characterization soil/sediment sampling procedures to be employed during the RA. The recommended laboratory methods to be utilized are presented on Table 5-1 of this QAPP. Final laboratory methods to be utilized will be provided by the selected analytical laboratory prior to commencing work.

Precision And Accuracy Quality Control Limits

Precision and accuracy quality control limits for chemical constituents analyzed as part of the characterization sampling will not undergo data review. Data comparability will be achieved through the use of standard CTDEP/USEPA approved methods. Data completeness will be assessed at the conclusion of the RA.

5.1.6 Miscellaneous Sampling

Data Uses

Miscellaneous sampling will be conducted to generate data to determine handling requirements for the following material, which will be generated during implementation of the RA:

- Effluent from the temporary wastewater treatment system; and
- Building components from demolition of the existing on-site process water facility.

Data Types

The miscellaneous sampling will include the collection and analysis of samples for laboratory analysis as described below:

- Surface water and/or groundwater which enters the active excavation area and water generated from soil/sediment dewatering activities (as applicable) will be pumped to an on-site temporary wastewater treatment system. Effluent samples from the temporary wastewater treatment system will be submitted for laboratory analysis, as described below, to confirm that limits for discharge to the local sanitary sewer system are achieved.
- In-situ samples (where physically practical) of the identified existing process water facility components in contact with PCB contaminated materials will be submitted for laboratory analysis to determine disposal requirements during the demolition process.

Data Quality

Sample analysis for miscellaneous samples will be conducted in accordance with USEPA standard methods. TPH analysis will be conducted by SW-846 Method 418.1

Data Quantity

The number of miscellaneous samples to be collected as part of the RA is presented below:

- Samples of the effluent water from the temporary on-site wastewater treatment system will be submitted based upon the requirements of the discharge permit; and
- The number of samples from the demolition of the process water facility will be determined during the RA effort.

Sampling and Analytical Methods

Field instruments used during the program will be calibrated daily to confirm appropriate analyses, as applicable. A summary of potential field equipment and calibration data is included in Table 5-4. Samples of building components will be submitted for laboratory analysis for PCBs, metals, VOCs, SVOCs, TPH, and other analytes as required by disposal vendors using EPA-approved methods. Samples effluent from the temporary water treatment system will be analyzed for those parameters specified in the discharge authorization.

Precision And Accuracy Quality Control Limits

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Precision and accuracy quality control limits will not be reviewed for miscellaneous samples submitted for laboratory analysis as part of the RA.

Data representativeness is addressed by the sample quantities and/or locations identified in the Field Sampling Plan. Data comparability will be achieved through the use of standard USEPA/CTDEP approved methods. Data completeness will be assessed at the conclusion of the RA.

5.2 Project Organization and Responsibilities

5.2.1 Project Organization

The RA will require integration of personnel from the organizations identified below, referred to as the project team. A detailed description of the responsibilities of each members of the project team is presented below.

5.2.2 Overall Project Management

LEA, on behalf of UTC/P&W, has overall responsibility for the RA at the site. LEA will perform the confirmatory soil/sediment sampling, disposal characterization sampling and miscellaneous sampling described in the Field Sampling Plan. In addition, LEA will be responsible for evaluating resultant sampling data and preparing required data submittals. UTC/P&W will provide project direction and oversight.

5.2.3 Team Member Responsibilities

This section of the QAPP discusses the responsibilities and duties of the project team members.

UTC/P&W

UTC/P&W Project Manager responsibilities and duties include:

- Overall direction of the RA;
- Direction of LEA; and
- Review of LEA work products, including data, memoranda, letters, reports, and all documents transmitted to the USEPA and CTDEP.
- Assure corrective actions are taken for deficiencies cited during audits of sampling/analytical activities.

LEA

LEA's responsibilities and duties include:

- Oversight of remedial work activities and products; and
- Coordination with UTC/P&W, USEPA and CTDEP.

More specifically, LEA personnel will have the following responsibilities:

LEA Project Manager

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Responsibilities and duties include:

- Management and coordination of all aspects of the project as defined in the RAWP with an emphasis on adhering to the objectives of the RA; and
- Coordination of office and field activities with P&W/UTC.

LEA Task Manager

Task Manager (Project Engineer/Geologist), as set forth in Section 5.2.3 will manage the ongoing sampling and analysis activities associated with the RA. Responsibilities and duties of each Task Manager include:

- Manage day to day remedial sampling activities;
- Develop, establish, and maintain files on remedial sampling activities;
- Review data from the remedial sampling activities;
- Assure corrective actions are taken for deficiencies cited during audits of remedial sampling activities;
- Overall QA/QC of the portions of the RA;
- Review all field records and logs;
- Instruct personnel working on remedial sampling activities;
- Coordinate field and laboratory schedules pertaining to remedial sampling activities;
- Ensure in coordination with the Quality Assurance Manager the preparation of QA/QC samples including performance evaluation samples;
- Request sample bottles from the laboratory;
- Review the field instrumentation, maintenance, and calibration to meet quality objectives;
- Prepare sections of reports pertaining to relevant RA; and
- Maintain field and laboratory files of field forms and logs, data reductions and calculations.

LEA Field Sampling Personnel

The field sampling personnel's responsibilities and duties include:

- Prepare sample labels and field paperwork
- Perform field procedures associated with the collection of samples as set forth in the FSP;
- Perform field analyses and collect QA samples;
- Calibrate, operate, and maintain field instrumentation equipment;
- Reduce field data;
- Maintain sample custody; and
- Complete field records and logs and provide copies to the LEA Task Manager.

Quality Assurance Manager (QAM)

The QAM's responsibilities and duties include:

- Review laboratory data packages;
- Coordinate field QA/QC activities with task managers, included audits of sampling activities, concentrating on field analytical measurements and practices to meet data quality objectives;

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- Review audit reports; and
- Prepare interim QA/QC compliance reports.
- The QAM will be independent of the unit generating the data.

An organizational chart specifically identifying these responsible parties is included in Appendix E.

5.2.4 Analytical Laboratory

Selected Analytical Laboratory

The selected analytical laboratory's general responsibilities and duties include:

- Perform sample analyses and associated laboratory QA/QC procedures;
- Supply sampling containers, shipping packages, and preservatives;
- Maintain laboratory custody of sample; and
- Strictly adhere to all protocols in the QAPP.

Laboratory Project Manager

The Laboratory Project Manager's responsibilities and duties include:

- Serve as primary communication contact between LEA and the laboratory technical staff;
- Monitor work loads and ensure availability of resources;
- Oversee preparation of analytical reports;
- Provide data validation packages as requested, and
- Supervise in house chain-of-custody.

Laboratory Quality Assurance Manager

The Laboratory QAM's responsibilities and duties include:

- Supervise the group which reviews and inspects all project related laboratory activities; and
- Conduct audits of all laboratory activities.

Laboratory Sample Custodian

The Laboratory Sample Custodian's responsibilities and duties include:

- Receive all samples; and
- Maintain custody of the samples and all documentation.

Laboratory Data Reviewer

The Laboratory Data Reviewer's responsibilities and duties include:

- Verify final analytical data prior to transmittal to LEA.

5.3 Quality Assurance Objective for Measurement of Data

5.3.1 General

This section identifies the parameters that will be measured in the field and parameters that will be analyzed in the laboratory as part of the RA sampling. This section also identifies the quality assurance parameters objectives for field measurement/laboratory analysis.

5.3.2 Field Parameters and Methods

Selected soil/sediment samples collected during the RA may be screened using PCB field test kits.

5.3.4 Laboratory Parameters and Methods

As described in the Field Sampling Plan, laboratory analyses will be performed during the RA to determine concentrations of the following:

- PCBs, metals, VOCs, SVOCs, TPH, and cyanide in confirmatory soil/sediment samples;
- PCBs, metals, VOCs, SVOCs, and cyanide in disposal characterization samples; Additional analyses may be performed to satisfy disposal vendor requirements.
- Specific analyses as required by the applicable permit(s) for samples of the effluent water from the temporary on-site wastewater treatment system; and
- Miscellaneous samples to be determined for disposal of demolition debris from the existing process water facility.

QA/QC analyses will be performed for analyses of PCBs, metals, VOCs, SVOCs, and cyanide as set forth on Table 4-4. Table 5-1 presents the recommended reporting limits for each of the analytes. The final reporting limits will be supplied by the selected laboratory prior to commencing work. The reporting limits will be at a concentration consistent with the appropriate criteria of the State of Connecticut Remedial Standard Regulations or lowest appropriate reporting limit for each compound, whichever is lower.

5.3.5 Measurement Performance Criteria

The overall quality assurance objective for the RA sampling and analysis program is to develop and implement procedures for sampling, preservation, chain-of-custody, laboratory analysis, instrument calibration, data reduction and reporting, internal quality control, audits, preventative maintenance, and corrective actions, such that valid data will be generated. The measurement performance criteria will be communicated to the laboratory by the LEA Project Manager in order to ensure that the data users' quality objectives are linked to verifiable measurement performance criteria. These procedures are presented in the following sections of the QAPP. Specific QC checks are also discussed in the following sections.

Quality assurance objective are generally defined in terms of the following DQIs:

- Representativeness;
- Comparability;
- Completeness;
- Precision; and
- Accuracy.

Each of the parameters mentioned above are discussed below. Specific objectives for the RA sampling and analysis program are set forth in other sections of this QAPP.

5.3.6 Representativeness

Representativeness is the degree to which sampling data accurately and precisely represents site conditions, and is dependent on sampling and the variability of environmental media at the site. The sampling program has been designed to assess the presence of the chemical constituents at the time of sampling. Representativeness may be measured through data collected for field duplicates, interlaboratory splits, field replicates, and previously analyzed samples. The FSP presents the rationale for sample quantities and location. The FSP and this QAPP presents field sampling methodologies and laboratory analytical methodologies, respectively. Data for confirmatory soil samples which do not meet criteria as specified in the Tier II data validation guidelines will be qualified accordingly and communicated to the end user.

5.3.7 Comparability

Comparability is the degree of confidence with which one data set can be compared to another. Comparability throughout the RA will be maintained through consistent use of the sampling and analytical methodologies set forth in this QAPP and the FSP through the use of established QA/QC procedures, use of the data management system and the utilization of appropriately trained personnel. Data for confirmatory soil samples which do not meet criteria as specified in the Tier II data validation guidelines will be qualified accordingly and communicated to the end user.

5.3.8 Completeness

Completeness is defined as a measure of the amount of valid data obtained from an event compared to the total amount that was obtained. Percent completeness will be calculated for all confirmatory soil / sediment sample data after Tier II validation is completed by comparing the ratio between the total number of rejected measurement points versus the total number of measurements. This will be determined upon final assessment of the analytical results, as discussed in Section 5.11 of this QAPP.

5.3.9 Precision

Precision is a measure of the reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the objective of the SAP. To maximize precision, specific sampling and analytical procedures will be followed. All sampling and analysis work for this RA will adhere to the established protocols presented in the QAPP and Field Sampling Plan. Checks for analytical precision may include the analysis of matrix spike, matrix spike duplicates, laboratory duplicates and field duplicates. Checks for field measurement precision may include obtaining duplicate field measurements. Precision will be assessed during the Tier II data validation. Data will be qualified based on Tier II data validation criteria for the above mentioned QC samples.. Data for confirmatory soil samples which do not meet criteria as specified in the Tier II data validation guidelines will be qualified accordingly and communicated to the end user.

5.3.10 Accuracy

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Accuracy is a measure of how close a measured result is to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, interlaboratory split samples, reference standards, matrix spikes, blank spikes, laboratory spikes, laboratory control samples and surrogate standards may be used to assess the accuracy of the analytical data. Accuracy will be evaluated during the Tier II validation procedures. Laboratory control limits will be assessed and data will be qualified based on Tier II data validation criteria for the above mentioned parameters. All qualified data will be communicated to the end user.

5.4 Sampling Procedures

Post-excavation confirmatory soil/sediment samples, disposal characterization samples and miscellaneous samples will be collected as described in the FSP. In the event of a variance in the field sampling procedures, a case narrative will be included in the field notes. The narrative will describe the nature of the variance in procedure, the reason for the variance, any effect the action may have on the data, and any corrective action taken. The LEA Project Manager will be notified immediately of any variance taken in field and/or laboratory procedures.

Sample containers will be ordered from the laboratory to ensure a sufficient number are in inventory at least 3 days prior to sampling. The number of containers will be in excess of the expected number of samples collected to prevent a shortage due to breakage. Chain-of-custody forms and custody seals (if necessary) will be kept in inventory in a similar manner.

5.5 Sample and Document Custody

5.5.1 General

This section identifies the field and laboratory procedures for the handling and documentation of samples collected as part of the RA. The field and laboratory sample handling and documentation procedures are presented below.

5.5.2 Field Procedures

The objective of field procedures for sample custody is to assure that samples are not tampered with from the time of sample collection through time of transport to the analytical laboratory. Persons will have "custody of samples" when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so the samples cannot be tampered with.

5.5.3 Laboratory Procedures

This subsection presents information related to laboratory sample custody, sample receipt and storage, sample analysis, laboratory documentation, and laboratory project files.

Sample Custody

Upon sample receipt, laboratory personnel will be responsible for sample custody. The original field chain-of custody form will accompany samples requiring laboratory analysis. Samples will be kept secured in the laboratory until all stages of analysis are complete.

Sample Receipt and Storage

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Immediately upon sample receipt, the laboratory sample custodian will verify the package seal, open the package, and compare the contents against the field chain of custody and sign as recipient. If a sample container is received broken, the sample is in an inappropriate container, or has not been preserved by appropriate means, LEA will be notified. The laboratory sample custodian will be responsible for logging in the samples, assigning a unique laboratory identification number to each sample, labeling the sample bottle with the laboratory identification number, and moving the sample to an appropriate storage location to await analysis.

Sample Analysis

Analysis of an acceptable sample will be initiated by worksheets, which contain all pertinent information for analysis. The analyst will sign and date the laboratory chain of custody form when removing the samples from storage.

Samples will be organized into sample delivery groups (SDGs) by the laboratory. A SDG may contain up to 20 field samples (field duplicates, performance evaluation samples, trip blanks, and equipment blanks are considered field samples for the purposes SDG assignment). All field samples assigned to a single SDG shall be received by the laboratory over a maximum of five calendar days (less, when five-day holding times for extraction must be met), and must be processed through the laboratory (preparation, analysis and reporting) as a group. Every SDG will include a minimum of one site-specific matrix spike/matrix spike duplicate (MS/MSD or MS/Dup) pair, which shall be received by the laboratory as part of the SDG assignment.

Each SDG will be self-contained for all of the required quality control samples. All parameters within an SDG will be extracted and analyzed together in the laboratory. At no time will the laboratory be allowed to run any sample (including QC samples) at an earlier or later time than the rest of the SDG. These rules for analysis will ensure that the quality control samples for an SDG are applicable to the field samples of the same SDG, and that the best possible comparisons may be made.

In case of a failure in the analytical system, the laboratory will be responsible for the necessary corrective action as described by the laboratory SOP or the analytical method. Any questionable laboratory data will be subjected to data validation as described in Region I, EPA-New England Data Validation Functional Guidelines For Evaluating Environmental Analyses, Rev. December 1996. As noted above, data validation packages will be requested for all confirmatory sampling data.

In the event of a variance in the laboratory analysis procedures, a case narrative will be included in the laboratory data package. The narrative will describe the nature of the variance in procedure, the reason for the variance, any effect the action may have on the data, and any corrective action taken. The LEA Project Manager will be notified immediately of any variance taken in field and/or laboratory procedures.

Laboratory Project Files

The laboratory will establish a file for all pertinent analytical data generated during the RA. The file will include the chain of custody forms, raw data, chromatograms (required for all constituents analyzed by chromatography), and sample preparation information. The laboratory will retain all project files and data packages for a period of five years.

Laboratory Documentation

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Workbooks, bench sheets, instrument logbooks, and instrument printouts are used to trace the history of the samples through the analytical process, and document and relate important aspects of the work, including the associated quality controls. As such, all logbooks, bench sheets, instrument logs, and instrument printouts are part of the permanent record of the laboratory.

Each page or entry is dated and initialed by the analyst at the time of entry. Errors in entry are crossed out in indelible ink with a single stroke, corrected without the use of whiteout or by writing directly over the erroneous entry, and initialed and dated by the individual making the correction.

Laboratory notebooks are periodically reviewed by the laboratory group leaders for accuracy, completeness, and compliance to this QAPP.

Computer and Hard Copy Storage

Gas Chromatograph/Mass Spectrometry (GC/MS) raw data files are maintained on computer disk for five years, hard copy GC chromatograms are maintained in files for a minimum of five years, or as dictated by the policy of the selected laboratory.

Sample Storage Following Analysis

The laboratory maintains samples for a minimum of one month after the final report is delivered to LEA, or for a duration equal to the sample holding time. After this period, the samples shall be transferred to P&W/UTC for disposal in accordance with applicable rules and regulations.

5.6 Calibration Procedures and Frequency

5.6.1 Field Equipment Maintenance and Calibration Procedures and Frequency

Any field equipment will be thoroughly inspected on a daily basis. Any equipment deficiencies will be noted and remedied prior to leaving for the site. Any equipment found not in good working order will be repaired or replaced as necessary. No equipment shall return to field use unless found to be in good working order after repair. The LEA Equipment Manager will be responsible for assuring replacement equipment is available in case of equipment malfunction. In the event of equipment malfunction, replacement equipment in good working order will be transported to the site.

Any critical spare parts for field equipment will be in stock prior to the start of the project. After the project begins, the inventory of spare parts will be replenished as needed by the Equipment Manager. Specific procedures for performing and documenting calibration and maintenance for the field equipment for total organic vapors are provided in the FSP. Field equipment, frequency of calibration, and calibration standards are provided in Table 5-4. Maintenance will be performed according to the instrument instruction manual.

Calibration standards for the pH meter, conductivity meter, and turbidity meter are purchased as solutions certified by the manufacturer.

5.6.2 Laboratory Equipment Calibration Procedures and Frequency

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Instrumentation calibration will follow the specifications provided by the SOPs for the analytical methods used as outlined in USEPA SW846.

5.7 Analytical Procedures

5.7.1 Field Analytical Procedures

Field analytical procedures may include field screening for PCBs using a field test kits. Specific field measurement quality in terms of precision and accuracy are presented in Table 5-5.

5.7.2 Laboratory Analytical Procedures

Specific requirements related to each sample medium to be analyzed and details of the methods to be used for this project are presented in the subsections below. The methods to be include the following:

- Standard USEPA methods will be used for the laboratory analysis of PCB's and the required analyses for the RA material disposal and permit requirements.
- CTDEP approved methods and updates will be used for laboratory analysis where applicable.

The anticipated turnaround times for receipt of analytical results for samples are summarized in the table below.

Sample Type	Turnaround Time
Post-excavation soil/sediment samples	24 hours to 2 weeks
Disposal characterization samples	24 hours to 2 weeks
Effluent samples from wastewater treatment system	24 hours to 2 weeks
Water treatment building demolition	1 week to 2 weeks

5.7.3 General Analytical Requirements

The number of environmental and QC samples to be analyzed are summarized in Tables 4.1 and 4-2. The analytical parameters, recommended methods and recommended reporting limits are presented in Table 5-1. Final methods and reporting limits will be provided by the analytical laboratory prior to commencing work.

5.7.4 Remedial Action Sample Matrices

Soil/Sediment, and Solids

Soil/sediment and solids analytical results will be determined on a dry weight analysis as specified in the appropriate sample extraction method. The results will be reported in the units presented in Table 5-1. Moisture content will be reported separately. Recommended QC limits for soil/sediment samples to be analyzed for PCBs, metals, VOCs, SVOCs and cyanide (at select locations) are presented in Table 5-2. The final limits will be established using the selected analytical laboratory's internal control limits.

Water

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Water from the temporary wastewater treatment system in this category that will be analyzed. Analytical results for the water analysis will be reported in the units identified in Table 5-1.

Analytical Requirements

The primary sources for methods used to analyze soil/sediment are provided in the USEPA documents. LEA will assess data usability of PCBs. The primary sources for methods used to analyze water samples associated with the on-site temporary wastewater treatment system are provided in 40 CFR 136.

Tables summarizing QC limits required to evaluate analytical performance are provided as follows:

Table	Title
5-2	Soil Analysis Quality Control Limits
5-3	Water Analyses Quality Control Limits

5.8 Data Reduction, Review, and Reporting

After field and laboratory data are obtained, the data will be subject to the following:

- Reduction or manipulation mathematically or otherwise into meaningful and useful forms;
- Review;
- Organization, interpretation, and reporting; and
- External data review.

The subsections below present descriptions of the data reduction, review, and reporting activities that will be conducted in the field and laboratory as part of the RA sampling and analysis program.

5.8.1 Field Data Reduction

Information collected in the field through visual observation, manual measurement and/or field instrumentation will be recorded in field forms. The LEA Task Manager will review such data for adherence to the FSP and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and as necessary, incorporated into the data evaluation process. Data reduction will be performed for the confirmatory soil/sediment sampling and the disposal characterization soil sampling associated with determining PCB concentrations using a field test kits.

5.8.2 Field Data Review

Field data calculations, transfers, and interpretations will be conducted by field personnel and reviewed for accuracy by the LEA Task Manager and the QAM. All logs and documents will be checked for:

- General Completeness;
- Readability;
- Usage of appropriate procedures;
- Appropriate instrument calibration and maintenance;
- Reasonableness in comparison to present and past data collected;
- Correct sample locations; and
- Corrected calculations and interpretations.

5.8.3 Laboratory Data Reduction

The calculations used for data reduction are specified in each of the analytical methods referenced previously. Whenever possible, analytical data is transferred directly from the instrument to a computerized data system. Raw data is entered into permanently bound laboratory notebooks. The data entered are sufficient to document all factors used to arrive at the reported value.

Concentration calculations for chromatographic analyses (as for example, PCBs, VOCs) are based on response factors. Quantitation is performed using internal or external standards.

5.8.4 Laboratory Data Review

All data will be subject to review by the laboratory. The analyst will review the data and enter it into the computer. The department manager will review the data and send it to the LIMS to be printed. The project manager will perform a final review of the final reports. The laboratory director will perform a final review prior to releasing data. If discrepancies exist in the analytical results, then corrective action is taken as discussed in Section 5.11.

5.8.5 Laboratory Data Reporting

The laboratory is responsible for preparing standard laboratory reports for all samples analyzed. Data will be tabulated by sample and method, with reference to both field and laboratory identifications. In addition, the laboratory will provide documentation backup (laboratory calculation sheets, chain of custody, etc.)

5.9 Field and Laboratory Quality Control Checks

5.9.1 General

Both field and laboratory quality control checks will be implemented during the RA. If a failure in the established sampling protocol occurs before the sample is collected, the field personnel shall use professional judgment to determine the location of an appropriate replacement sample. This alternative sample location will be documented in the field forms, and the information as to the reason for and location of the alternative sampling will be reported to the LEA Project Manager or designated person. If a failure in the established sampling protocol occurs after sample submission (for example, if part of the complete sample set is found to be inadmissible), the Project Manager will determine the location of replacement samples and collection methodology. The proposed field and laboratory control checks are discussed below.

5.9.2 Field Quality

Field quality control checks will include obtaining duplicate field measurements, using analyte-free water for the preparation of sample blanks, using clean sample containers, collecting duplicate samples, and preparing rinse blanks, as further described in the subsections below.

5.9.3 Field Measurements

To verify the quality of data using field instrumentation, duplicate measurements will be obtained and reported for all field measurements.

5.9.4 Sample Containers

Certified-clean sample containers will be supplied by analytical laboratory. Certificates of analysis will be filed in the project file.

5.9.5 Field Duplicates

Field duplicates will be collected for soil/sediment samples to verify the reproducibility of the sampling methods. Field duplicates will be prepared as discussed in the FSP. In general, soil and soil/sediment sample field duplicates will be analyzed at a frequency of one every 20 samples for chemical constituents. Table 4-4 provides an estimated number of field duplicates to be prepared for each applicable parameter and matrix. Acceptable field duplicate precision for soil samples will have an RPD of less than 50%. Data that do not meet the criteria will be qualified according to USEPA Region I, Data Validation Guidelines, revised December 1996.

5.9.6 Equipment Blanks

Equipment blanks are used to monitor the cleanliness of sampling equipment and the effectiveness of the decontamination procedures. Equipment blanks will be prepared and submitted for analysis at a frequency of one every 20 samples. Equipment blanks will be prepared by filling sample containers with analyte free water, which has been routed through a cleaned sampling device. If dedicated sampling devices are used or sample containers are used to collect the samples, rinse blanks will not be required. Table 4-4 provides the estimated number of equipment blanks for environmental samples to be collected. The criterion for equipment blanks is such that no target compound should be present at or above the laboratory quantitation limit. Data that do not meet the criteria will be qualified using the 5X action rule according to USEPA Region I Data Validation Guidelines, Revisions December 1996.

5.9.7 Method Blanks

Sources of contamination in the analytical process, whether specific analytes or interferences, need to be identified, isolated, and corrected. The method blank is useful in identifying possible sources of contamination within the analytical process. For this reason, it is necessary that the method blank is initiated at the beginning of the analytical process and encompasses all aspects of the analytical work. As such, the method blank would assist in accounting for potential contamination attributable to glassware, reagents, instrumentation, or other sources, which could affect the sample analysis. One method blank will be analyzed with each analytical series associated with no more than 20 samples. The criterion for method blanks is such that no target compound should be present at or above the laboratory quantitation limit. Data that do not meet the criteria will be qualified using the 5X action rule (10X rule for common laboratory contaminants) according to USEPA Region I Data Validation Guidelines, Revisions December 1996.

5.9.8 Matrix Spike/Matrix Spike Duplicates

MS/MSD will be used to measure the accuracy and precision of organic analyte recovery from sample matrices. All MS/MSD will be site specific. For PCBs, metals, VOCs, SVOCs, and cyanide matrix spike/matrix spike duplicate pairs will be analyzed at a frequency of one every 20 samples.

The percent recovery (%R) and the relative percent difference (RPD) will be evaluated for MS/MSD data and compared with the acceptance criteria as stated in the appropriate EPA analytical method. When MS recoveries and RPDs are outside QC limits, associated MS blank and surrogate recoveries will be evaluated to attempt to verify the reason for deviation and determine the effects on the reported sample results. In addition, the percent relative standard deviation (%RSD) will be calculated for the unspiked sample, the MS and the MSD and will be considered a triplicate in determining overall precision of the analytical method. The unspiked sample results will be qualified according to the to USEPA Region I Data Validation Guidelines, Revisions December 1996 for any data that is outside acceptable control limits. Table 4-4 presents the estimated number of MS/MSD analyses for each applicable matrix and parameter.

5.9.9 Surrogates

Surrogates are compounds, which are unlikely to occur under natural conditions that have properties similar to the analytes of interest. This type of control is primarily used for organic samples analyzed by GC/MS and GC methods and is added to the sample prior to extraction. The surrogate spike is utilized to provide broader insight into the proficiency and efficiency of an analytical method on a spike specific basis.

If surrogate recoveries exceed specified QC limits, then the analytical results need to be evaluated thoroughly in conjunction with other control measures. Recoveries for surrogate compounds in samples, QC samples and blanks must be within the QC acceptance criteria as specified in the appropriate EPA analytical method. Samples with surrogate compounds outside acceptance will be qualified according to USEPA Region I Data Validation Guidelines, Revisions December 1996. Surrogate compounds will be selected utilizing the guidance provided in the analytical methods summarized in Table 5-2.

5.9.10 Calibration Standards

Compliance requirements for initial calibration are established to ensure that the instrument is capable of producing acceptable qualitative and quantitative data. Calibration check standards will be analyzed as specified in the applicable analytical method. In analyses where internal standards are used, a calibration check standard will only be analyzed in the beginning of an analytical series. If the results of the calibration check standard exceeds specified tolerances, then all samples analyzed since the last acceptable calibration check standard will be re-analyzed

Laboratory instrument calibration standards will be selected utilizing the guidance provided in the recommended analytical methods summarized in Table 5-1 or other appropriate method defined prior to commencing work. Calibration data will be evaluated based on USEPA Region I Data Validation Guidelines, Revisions December 1996. Data that does not meet acceptance criteria will be qualified accordingly.

5.9.11 Internal Standards

Instrument performance, stability and laboratory precision throughout an analytical sequence is monitored by the addition of internal standard compounds. Internal standard areas and retention times are monitored for organic analysis performed by GC/MS methods. Method specific internal standard compounds are spiked into all field samples, calibration standards and QC samples after preparation and prior to analysis. If the internal standard areas in one or more samples exceed the specified tolerances, then the instrument will be recalibrated and all affected samples reanalyzed.

The acceptability of internal standard performance will be determined using the guidance provided within the analytical methods summarized in Table 5-1 and other methods deemed appropriate by the selected analytical laboratory prior to commencing work. Sample results with internal standard areas and/or retention time data outside control limits will be qualified based on USEPA Region I Data Validation Guidelines, Revisions December 1996

5.9.12 Reference Standards

Reference standards are standards of known concentration, and independent in origin from the calibration standards. Reference standards, are generally available through the USEPA, the National Bureau of Standards, or are specified in analytical methods. The intent of reference standard analysis is to provide insight into the analytical proficiency within an analytical series.

5.9.13 Performance Evaluation Program

Performance Evaluation Audit

Data for performance evaluation samples will be generated to provide information on the overall accuracy and bias of the analytical method and on laboratory performance. UTC/P&W will conduct a performance evaluation (PE) audit as part of the program following "USEPA Region I Performance Evaluation Program Guidance," July 1996 Revision. Based upon the criteria presented in Attachment H of the USEPA Region I PE program guidance document, only aqueous PE samples will be submitted for this program. An overview of the proposed PE audit program is as follows:

- LEA will coordinate PE sample acquisition with the selected vendor prior to initiating the RA program;
- Sample acquisition, handling, and analyses will be in general accordance with USEPA Region I guidance criteria; and
- It is estimated that a total of four PE aqueous samples will be submitted as part of the program.

All samples in a sample delivery group will be validated based upon a comparison between the vendor-certified performance evaluation (PE) results and the laboratory's reported results. PE samples will be evaluated for false negatives, false positives, and inaccurate target compound quantitation. The PE samples provide information on the magnitude and direction of quantitative bias for the laboratory method. Results that are outside the vendor-certified acceptance limits will be qualified according to USEPA Region I Data Validation Guidelines, Revisions December 1996.

5.10 Performance and System Audits

5.10.1 General

This section describes the performance and system audits that will be completed in the field and the laboratory during implementation of RA.

5.10.2 Audits

Field performance and systems audits that will be completed during this project are described in the subsection below. The results of all audits and reviews, along with recommendations for corrective action, will be given to the LEA Project Manager as soon as possible in order to assess the need for any corrective action.

Readiness Reviews

Readiness reviews will be conducted prior to commencing each phase of the project on an as-needed basis to ensure all components required for each phase are in place.

Surveillance

Surveillance of remedial activities will be conducted by the LEA Task Manager or other field personnel on-site on a daily basis. Activities should be documented in the field notes. Any deviations from the FSP or QAPP should be reported to the Project Manager as soon as possible.

Technical System Audit

A Technical System Audit (TSA) shall be performed by the LEA Project Manager or person designated by the Project Manager shortly after commencing remedial activities. The purpose of the TSA is to ensure that facilities, personnel, training, procedures and record keeping are in accordance with the QAPP. Performing this early in the project provides opportunity for corrective action.

Audit of Data Quality

An audit of data quality will be performed by the management team prior to final reporting. This will serve to reveal how the data were handled, what judgments were made, and whether uncorrected mistakes were made.

5.10.3 Performance Audits

The LEA Task Manager will monitor field performance. Field performance audit summaries will contain an evaluation of field measurements and field meter calibration to verify that measurements are taken according to established protocols. The QAM will review all field reports and communicate concerns to the Project Manager and/or Task Managers.

5.10.4 Internal System Audits

A field internal system audit is a qualitative evaluation of all components of field QA/QC. The system audit compares scheduled QA/QC activities from this document with actual QA/QC activities completed.

5.10.5 Laboratory Audits

The analytical laboratory will perform internal audits consistent with applicable regulations. LEA reserves the right to conduct an on site audit of the laboratory prior to start of analyses for the project.

5.11 Data Assessment Procedures

The analytical data generated during the RA will be evaluated with respect to precision, accuracy, and completeness and compared to the data quality objectives set forth in this QAPP. A summary of recommended QC limits required to evaluate analytical performance is provided in Tables 5-2 and 5-3. Final QC limits will be established using the selected analytical laboratory's internal control limits.

Following the collection of field sampling and analytical data, various statistical analyses can be performed to determine the data usability and sensitivity of the data.

Data usability can be checked through standard data validation procedures, and statistical cross validation procedures. These procedures involve predicting a data value for one point, based on results from other points. The difference between the measured and predicted number can indicate an invalid result. An assessment of data sufficiency involves the determination of whether the confidence intervals values are rigorous enough to satisfy regulatory or engineering requirements.

5.11.1 Data Precision Assessment Procedures

Field precision will be controlled through the use of experienced field personnel, properly calibrated instruments, and duplicate field measurements. Field duplicates will be used to assess precision for the entire measurement system, including sampling, handling, shipping, storage, preparation, and analysis.

Laboratory data precision analyses will be monitored through the use of matrix spike/matrix spike duplicate sample analyses and performance evaluation samples. The precision of data will be measured by calculation of the relative percent difference (RPD) by the following equation:

$$RPD = \frac{(A-B)}{A+B/2} \times 100$$

Where:

A = Analytical results from first duplicate measurement

B = Analytical results from second duplicate measurement.

5.11.2 Data Accuracy Assessment Procedures

The accuracy of field precision will be controlled by experienced field personnel, properly calibrated field instruments, and adherence to established protocols. The accuracy of field instruments will be assessed by review of calibration and maintenance logs.

Laboratory accuracy will be assessed via the use of matrix spike, surrogate spikes, PE samples, and reference standards. Where available and appropriate, QA performance standards will be analyzed periodically to assess laboratory accuracy. Accuracy will be calculated in terms of percent recovery as follows:

$$\text{Percent Recovery} = \frac{(A-X)}{B} \times 100$$

Where:

A = Value measured in spiked sample

X = Value measured in original sample

B = True value of amount added to sample or true value of standard.

This formula is derived under the assumption of constant accuracy between the original and spiked measurements. Recommended accuracy objectives for matrix spike recoveries are found in Tables 5-2 and 5-3. Final accuracy objectives for matrix spike recoveries will be determined by the selected analytical laboratory's internal control limits.

5.11.3 Data Completeness Assessment Procedures

Completeness of field or laboratory data set will be calculated by comparing the number of valid sample results generated to the total number of results generated:

$$\text{Completeness} = \frac{\text{Number of Valid Results}}{\text{Total Number of Results Generated}} \times 100$$

As a general guideline, overall project completeness is expected to be at least 90%. The assessment of completeness will require professional judgment to determine data usability for intended purposes.

5.11.4 Internal Reporting

The QAM will review analytical concerns identified by the data review with the laboratory. Supporting data (i.e. historic data, related field or laboratory data) will be reviewed to assist in determining data quality, as appropriate. The QAM will incorporate results of assessments of data usability into a summary that will be submitted to the Project Manager and appropriate Task Managers.

5.11.5 RA Reporting

The summary report prepared by LEA will contain a QA/QC section summarizing the quality of data collected and/or used as appropriate to the project data quality objectives, which are discussed in this QAPP. The QAM will prepare the QA/QC summaries using reporting and memoranda documenting the data assessment and review.

5.11.6 Data Validation

A standardized data validation review process for judging the analytical quality and usefulness of data will be performed in accordance with the procedures set forth in the most current editions of the USEPA Region I Laboratory Data Validation Functional Guidelines for Evaluating Environmental Analyses. Technical judgment on the validity of the laboratory results will be provided to determine the overall usability and legal defensibility. All confirmatory sample data obtained will be validated. Individual sample results will be accepted, rejected, or qualified. Validation decisions will be communicated to the

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end-user through a written data validation memorandum and all qualifiers applied to the individual sample results will be incorporated into the analytical database.

The following items will be reviewed when applicable:

- Data Completeness;
- Custody Documentation;
- Preservation and Holding Times;
- Instrument Performance;
- Initial and Continuing Calibration;
- Blanks;
- Field Duplicate Precision;
- Surrogate Compounds and Recoveries;
- Internal Standard Compounds, Recoveries and Retention Times;
- Matrix Spike Recoveries/Duplicate Correlations;
- Control Spike/Laboratory Control Spike;
- Performance Evaluation Assessment;
- Instrument Detection Limits (IDLs);
- ICP Interference Check Sample;
- Furnace Atomic Absorption Analysis;
- ICP Serial Dilution;
- Method Compliance; and
- Sample Result Verification.
- Overall Evaluation of Data

Project requirements are for full Tier II validation of 100% of the confirmatory field samples within each data package.

5.12 Reports to Management.

Daily reports on remedial activities (verbal or written) will be given from field personnel to the LEA Project Manager or person designated by the Project Manager.

Laboratory reports will be given to the Project Manager as received.

Memorandums regarding data validation will be provided to the Project Manager after complete review of the laboratory data package by the data validation staff.

Table 4-1

**Willow Brook and Willow Brook Pond
East Hartford, Connecticut**

**Field Sampling Plan
Confirmatory Sampling Summary**

Sample Type	Sample Media	Anticipated Number of Samples	Laboratory Analytical Methods (USEPA)
Confirmatory	Soil/Sediment	197	SW846-8082, Rev. December 1996(PCB)
Confirmatory	Soil/Sediment	76	SW-846-8260B Rev. December 1996 (VOC) SW-846-8270C Rev. December 1995 (SVOC) SW-846-1312 Rev. September 1994 (SPLP) SW-846-6010B Rev. December 1996 (ICP Metals) SW-846-7010 Rev. January 1998 (GFAA Metals) SW-846-7471A Rev. January 1998 (Mercury–Cold Vapor) SW-846-9012A Rev. December 1996 (Cyanide) TPH 418.1
Disposal/ Characterization (Possible Methods Required By Disposal Facility)	Soil/Sediment	24 or As Required by Disposal Facility	SW846-8082, Rev. December 1996(PCB) SW-846-8260B Rev. December 1996 (VOC) SW-846-8270C Rev. December 1995 (SVOC) SW-846-1312 Rev. September 1994 (SPLP) SW-846-6010B Rev. December 1996 (ICP Metals) SW-846-7010 Rev. January 1998 (GFAA Metals) SW-846-7471A Rev. January 1998 (Mercury–Cold Vapor) SW-846-9012A Rev. December 1996 (Cyanide) TPH 418.1
Temporary Wastewater Treatment System Effluent	Wastewater	As Required By Permit	VOC: EPA-601 and 602 plus xylenes or EPA624 MTBE: EPA-602 or EPA-624 TPH: EPA 418.1 Metals: EPA-200.7, 239.1 or 239.2 BNA: EPA-625 PAH: EPA-610 PCBs: EPA-608 Cyanide: EPA-335.1; 335.2

Notes:

- Samples are collected from an interval of 0 to 6 inches below post-remediation surface.
- PCB = Polychlorinated Biphenyls
VOC = Volatile Organic Compounds
ICP = Inductively Coupled Plasma
MTBE = Methyl tertiary butyl ether
PAH = Polynuclear Hydrocarbons

SVOC = Semi-Volatile Organic Compounds
SPLP = Synthetic Precipitate Leachate Procedure
TPH = Total Petroleum Hydrocarbons
BNA = Base Neutral and Acid Extractables
GFAA = Graphite Furnace Atomic Absorption Spectrometry
- USEPA = United States Environmental Protection Agency

Table 4-2

**Willow Brook and Willow Brook Pond
East Hartford, Connecticut**

**Field Sampling Plan
Detailed Confirmatory Sampling Summary
by Remediation Area**

Excavation Area	Bottom Composite Samples				Bottom Grab Samples				Sidewall Composite Samples					Sidewall Grab Samples					
	Excavation Area (Square Feet)	# PCB Aliquots	# PCB Composites	Square Feet Per Sample	# PCBs	Square Feet Per Sample	# Other Parameters	Square Feet Per Sample	Perimeter (Feet)	Depth of Excavation (Feet)	# PCB Aliquots	# PCB Composites	Square Feet Per Sample	Perimeter (Feet)	Depth of Excavation (Feet)	# PCBs	Square Feet Per Sample	# Other Parameters	Square Feet Per Sample
1	1,000				1	1,000	1	1,000						120	4	2	240	2	240
2	3,000	10	3	1,000					240	5	20	5	240						
3	1,600	6	2	800					150	5	12	3	250						
4	4,800	10	3	1,600					260	12	40	10	312	260	12	10	312	10	312
5	750	4	1	750					100	5	6	2	250						
6	1,300	6	2	650					130	2	4	1	260						
7	1,100				1	1,100	1	1,100						130	5	3	217	3	217
8	880				1	880	1	880						120	5	2	300	2	300
9	1,100	5	2	550					120	2	4	1	240	140	2	2	140	2	140
10	3,100	6	2	1,550					180	4	12	3	240						
11	26,000	162	17	1,529	17	1,529	17	1,529	540	4	28	7	309	400	4	5	320	5	320
12	1,600	3	1	1,600					200	3	8	2	300						
13	4,200	12	3	1,400					280	3	12	3	280						
14	31,000	86	20	1,550	20	1,550	20	1,550	930	4	48	12	310	930	4	12	310	12	310
15	13,900	39	11	1,264					420	3	20	5	252						
Totals		349	67		40		40				214	54				36		36	
Average (Samples/s.f.)				1,187				1,212					270						263

Notes:

- Other Parameters: refer to analytical methods as described in Table 4-1, Confirmatory Sampling Summary for details.
- One PCB bottom aliquot sample will be collected per 400 square foot node. Not more than 4 aliquots will be combined to form 1 bottom composite sample which represents a 1,600 square foot area.
- One PCB sidewall aliquot sample will be collected per 80 square foot node. Not more than 4 aliquots will be combined to form 1 sidewall composite sample which represents a 320 square foot area.
- One PCB bottom grab sample will be collected per 1,600 square foot area.
- One PCB sidewall grab sample will be collected per 320 square foot area.
- A total of 121 PCB composite samples will be collected which equates to one PCB composite sample per 778 square feet
- A total of 76 PCB grab samples will be collected which equates to one PCB grab sample per 762 square feet
- A total of 197 PCB samples will be collected.
- A total of 76 Other Parameter samples will be collected.

Table 4-3

**Willow Brook and Willow Brook Pond
East Hartford, Connecticut**

**Field Sampling Plan
Extraction Method Summary**

Analytes	Analytical Method	Extraction Methods Aqueous Samples	Extraction Methods Soil and Sediment Samples	Extraction Methods Concrete Samples
PCBs	SW-846 Method 8082	3510C	3545	3545
VOCs	SW-846 Method 8260B	5030B	5035	5035
SVOCs	SW-846 Method 8270C	3510C	3550B	3550B
RCRA 8 metals (plus copper, nickel and zinc)	SW-846 6010B	3010A	3050B	3050B
Cyanide	SW846 9012	9012	9012	9012
TPH	418.1	418.1	418.1	418.1
Pesticides	8081A	3510C	3550B	3550B
Herbicides	8151A	3510C	3550B	3550B

If sample has less than 5% solids it is considered an aqueous sample. Greater than 5% solids is a soil or sediment sample.

Sulfuric acid cleanup for PCBs = 3665A

Sulfur cleanup for Pesticides & PCBs = 3660B

Forisil cleanup for Pesticides & PCBs = 3620B

Table 4-4

Willow Brook and Willow Brook Pond
East Hartford, Connecticut

Field Sampling Plan
Quality Control Analyses Summary

Environmental Sample Matrix / Laboratory Parameters	Estimated Environmental Sample Quantity	Field QC Analyses						Estimated Matrix Total	Laboratory QC Analyses								Estimated Overall Total
		Trip Blank		Field Duplicate		Equipment Blank ^a			MS ^a		MSD ^a		SB ^a		PE Sample		
		Freq	No.	Freq	No.	Freq	No.		Freq	No.	Freq	No.	Freq	No.	Freq.	No.	
Post-Excavation Confirmation Sediment/Soil Samples																	
PCB	197	NA	NA	1/20	10	1/20	10	217	1/20	10	1/20	10	1/20	10	1/20	10	257
SVOC, VOC, TPH, Metals, Cyanide	76	1/Day	15	1/20	4	1/20	4	99	1/20	4	1/20	4	1/20	4	1/20	4	115

Notes:

1. Table assumes that samples will be processed in groups of 20 samples for QC analyses. If smaller sample groups are processed, the one MS/MSD (or MS/laboratory duplicate) per sample delivery group (up to 20 samples) will be prepared for each sample delivery group.
2. These field and laboratory QC analysis shall be performed at a frequency of 1/20 or 1/week, whichever comes first. Table assumes samples will be collected at a rate of 20 samples per week.
3. QA/QC samples will not be collected for confirmation soil samples, confirmation sediment samples, or water samples from the temporary on-site water treatment system.
4. PCB = Polychlorinated Biphenyls.
SVOC = Semi-Volatile Organic Compounds
VOC = Volatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
5. NA: Not applicable.

MS, MSD, SB, and PE

MS = Matrix Spike
MSD = Matrix Spike Duplicate
SB = Surrogate Blank
PE = Performance Evaluation Sample

Table 4-5
Required Containers, Preservatives, and Analysis
Holding Times for Solid and Aqueous Samples

Fraction	Soil/Solid Sample Bottle	Preservative	Holding Time
TCL Volatiles	2-40 ml glass screw cap vials with Teflon septa	Cool to 4 C.	14 days
TCL Semivolatiles	1-16 oz. glass w/Teflon lined enclosure.	Cool to 4 C.	14 days till extraction/40 days to inject extract
TCL Organochlorine Pesticides/Herbicides/PCBs	from same 16 oz. above	Cool to 4 C.	14 days till extraction/40 days to inject extract
RCRA 8 metals (plus nickel and zinc)	from same 16 oz. above	Cool to 4 C.	28 days Hg & 180 days all other metals
Cyanides	from same 4 oz. above	Cool to 4 C.	14 days
			days to complete analysis
Total Petroleum Hydrocarbons 418.1	from same 16 oz. above	Cool to 4 C.	28 days
Trip Blank, Field Blank or Aqueous Sample			
TCL Volatiles	2-40 ml glass screw cap vials with Teflon septa	HCl to pH <2, Cool to 4 C.	14 days
TCL Semivolatiles	2-1 liter amber glass with Teflon lined cap	Cool to 4 C.	7 days extraction/40 days to inject
TCL Organochlorine Pesticides/Herbicides/PCBs	2-1 liter amber glass with Teflon lined cap	Cool to 4 C.	7 days extraction/40 days to inject
RCRA 8 metals (nickel and zinc)	1-1 liter HDP	HNO to pH<2	28 days Hg & 180 days all other metals
Cyanides	1-1 liter HDP	NaOH to pH >12, Cool to 4 C.	14 days
Total Petroleum Hydrocarbons 418.1	2-1 liter amber glass with Teflon lined cap	Cool to 4 C. pH<2	28 days

NOTES:

- 1 - Depending on how sample analyses are distributed between the laboratories, additional sample bottles may be required.
- 2 - Holding times are from the date of sample collection.

Table 5-1

**RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED**

Page 1 of 6

CAS#	Analyte Name	Type	Project Quantitation Limits				
			Method	Aqueous	Units	Soil *	Units
67-64-1	Acetone	VOA	SW846-8260B	20.0	ug/l	20.0	ug/kg
75-05-8	Acetonitrile	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
107-02-8	Acrolein	VOA	SW846-8260B	5.0	ug/l	20.0	ug/kg
107-13-1	Acrylonitrile	VOA	SW846-8260B	1.0	ug/l	10.0	ug/kg
107-05-1	Allyl chloride	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
71-43-2	Benzene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-27-4	Bromodichloromethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-25-2	Bromoform	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
74-83-9	Methyl bromide (bromomethane)	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
78-93-3	Methyl ethyl ketone (2-Butanone)	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
75-15-0	Carbon disulfide	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
56-23-5	Carbon tetrachloride	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
108-90-7	Chlorobenzene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-00-3	Chloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
67-66-3	Chloroform	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
126-99-8	Chloroprene	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
74-87-3	Methyl chloride (Chloromethane)	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
124-48-1	Dibromochloromethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
96-12-8	1,2-Dibromo-3-chloropropane	VOA	SW846-8260B	0.5	ug/l	5.0	ug/kg
74-95-3	Dibromomethane (methylene bromide)	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
106-93-4	Ethylene dibromide (EDB)	VOA	SW846-8260B	0.5	ug/l	5.0	ug/kg
110-57-6	trans-1,4-Dichloro-2-butene	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
75-71-8	Dichlorodifluoromethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-34-3	1,1-Dichloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
107-06-2	1,2-Dichloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-35-4	1,1-Dichloroethene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
156-59-2	cis-1,2-Dichloroethene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
156-60-5	trans-1,2-Dichloroethene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
78-87-5	1,2-Dichloropropane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
542-75-6	1,3-Dichloropropene (total)	VOA	SW846-8260B	1.0	ug/l	10.0	ug/kg
123-91-1	1,4-Dioxane	VOA	SW846-8260B	25.0	ug/l	50.0	ug/kg
100-41-4	Ethylbenzene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
97-63-2	Ethyl methacrylate	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
591-78-6	2-Hexanone	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
78-83-1	Isobutyl alcohol	VOA	SW846-8260B	25.0	ug/l	50.0	ug/kg
126-98-7	Methacrylonitrile	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
75-09-2	Methylene chloride	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
74-88-4	Methyl iodide	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
80-62-6	Methyl methacrylate	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
108-10-1	4-Methyl-2-pentanone	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
1634-04-4	Methyl-tert-butyl ether	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
107-12-0	Propionitrile	VOA	SW846-8260B	5.0	ug/l	10.0	ug/kg
100-42-5	Styrene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
630-20-6	1,1,1,2-Tetrachloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
79-34-5	1,1,1,2,2-Tetrachloroethane	VOA	SW846-8260B	0.5	ug/l	5.0	ug/kg
127-18-4	Tetrachloroethene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg

Table 5-1

**RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED**

Page 2 of 6

CAS#	Analyte Name	Type	Project Quantitation Limits				
			Method	Aqueous	Units	Soil *	Units
108-88-3	Toluene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
71-55-6	1,1,1-Trichloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
79-00-5	1,1,2-Trichloroethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
79-01-6	Trichloroethene	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-69-4	Trichlorofluoromethane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
108-05-4	Vinyl acetate	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
96-18-4	1,2,3-Trichloropropane	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
75-01-4	Vinyl chloride	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
1330-20-7	Xylenes (total)	VOA	SW846-8260B	1.0	ug/l	5.0	ug/kg
83-32-9	Acenaphthene	SV	SW846-8270C	5	ug/l	170	ug/kg
208-96-8	Acenaphthylene	SV	SW846-8270C	5	ug/l	170	ug/kg
98-86-2	Acetophenone	SV	SW846-8270C	5	ug/l	170	ug/kg
53-96-3	2-Acetylaminofluorene	SV	SW846-8270C	5	ug/l	170	ug/kg
92-67-1	4-Aminobiphenyl	SV	SW846-8270C	5	ug/l	170	ug/kg
62-53-3	Aniline	SV	SW846-8270C	5	ug/l	170	ug/kg
120-12-7	Anthracene	SV	SW846-8270C	5	ug/l	170	ug/kg
140-57-8	Aramite	SV	SW846-8270C	5	ug/l	170	ug/kg
56-55-3	Benzo[a]anthracene	SV	SW846-8270C	5	ug/l	170	ug/kg
205-99-2	Benzo[b]fluoranthene	SV	SW846-8270C	5	ug/l	170	ug/kg
207-08-9	Benzo[k]fluoranthene	SV	SW846-8270C	5	ug/l	170	ug/kg
191-24-2	Benzo[ghi]perylene	SV	SW846-8270C	5	ug/l	170	ug/kg
50-32-8	Benzo[a]pyrene	SV	SW846-8270C	5	ug/l	170	ug/kg
100-51-6	Benzyl alcohol	SV	SW846-8270C	5	ug/l	170	ug/kg
111-91-1	bis(2-Chloroethoxy) methane	SV	SW846-8270C	5	ug/l	170	ug/kg
111-44-4	bis(2-Chloroethyl)ether	SV	SW846-8270C	5	ug/l	170	ug/kg
108-60-1	2,2'-oxybis(1-chloro-Propane)	SV	SW846-8270C	5	ug/l	170	ug/kg
117-81-7	bis(2-Ethylhexyl)phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
101-55-3	4-Bromophenyl phenyl ether	SV	SW846-8270C	5	ug/l	170	ug/kg
85-68-7	Butyl benzyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
86-74-8	Carbazole	SV	SW846-8270C	5	ug/l	170	ug/kg
106-47-8	4-Chloroaniline	SV	SW846-8270C	10	ug/l	330	ug/kg
59-50-7	4-Chloro-3-methyl phenol	SV	SW846-8270C	5	ug/l	170	ug/kg
91-58-7	2-Chloronaphthalene	SV	SW846-8270C	5	ug/l	170	ug/kg
95-57-8	2-Chlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
7005-72-3	4-Chlorophenyl phenyl ether	SV	SW846-8270C	5	ug/l	170	ug/kg
218-01-9	Chrysene	SV	SW846-8270C	5	ug/l	170	ug/kg
132-64-9	Dibenzofuran	SV	SW846-8270C	5	ug/l	170	ug/kg
84-74-2	Di-n-butyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
117-84-0	Di-n-octyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
53-70-3	Dibenz[a,h]anthracene	SV	SW846-8270C	5	ug/l	170	ug/kg
95-50-1	1,2-Dichlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
541-73-1	1,3-Dichlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
106-46-7	1,4-Dichlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
91-94-1	3,3-Dichlorobenzidine	SV	SW846-8270C	5	ug/l	170	ug/kg
120-83-2	2,4-Dichlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg

Table 5-1

**RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED**

Page 3 of 6

CAS#	Analyte Name	Type	Project Quantitation Limits				
			Method	Aqueous	Units	Soil *	Units
84-66-2	Diethyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
297-97-2	0,0-Diethyl-0-2-pyrazinyl	SV	SW846-8270C	5	ug/l	170	ug/kg
60-51-5	Dimethoate	SV	SW846-8270C	5	ug/l	170	ug/kg
60-11-7	p-(Dimethylamino)azobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
57-97-6	7,12-Dimethylbenz(a)anthracene	SV	SW846-8270C	5	ug/l	170	ug/kg
122-09-8	alpha, alpha.-Dimethylphenethylamine	SV	SW846-8270C	25	ug/l	830	ug/kg
119-93-7	3,3-Dimethylbenzidine	SV	SW846-8270C	5	ug/l	170	ug/kg
105-67-9	2,4-Dimethylphenol	SV	SW846-8270C	5	ug/l	170	ug/kg
131-11-3	Dimethyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
99-65-0	1,3-Dinitrobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
534-52-1	4,6-Dinitro-2-methylphenol	SV	SW846-8270C	5	ug/l	170	ug/kg
51-28-5	2,4-Dinitrophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
121-14-2	2,4-Dinitrotoluene	SV	SW846-8270C	5	ug/l	170	ug/kg
606-20-2	2,6-Dinitrotoluene	SV	SW846-8270C	5	ug/l	170	ug/kg
117-84-0	Di-n-octyl phthalate	SV	SW846-8270C	5	ug/l	170	ug/kg
88-85-7	Dinoseb	SV	SW846-8270C	5	ug/l	170	ug/kg
122-39-4	Diphenylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
298-04-4	Disulfoton	SV	SW846-8270C	5	ug/l	170	ug/kg
65-50-0	Ethyl methanesulfonate	SV	SW846-8270C	5	ug/l	170	ug/kg
52-85-7	Famphur	SV	SW846-8270C	5	ug/l	170	ug/kg
206-44-0	Fluoranthene	SV	SW846-8270C	5	ug/l	170	ug/kg
86-73-7	Fluorene	SV	SW846-8270C	5	ug/l	170	ug/kg
118-74-1	Hexachlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
87-68-3	Hexachlorobutadiene	SV	SW846-8270C	5	ug/l	170	ug/kg
77-47-4	Hexachlorocyclopentadiene	SV	SW846-8270C	5	ug/l	170	ug/kg
67-72-1	Hexachloroethane	SV	SW846-8270C	5	ug/l	170	ug/kg
70-30-4	Hexachlorophene	SV	SW846-8270C	5	ug/l	170	ug/kg
1888-71-7	Hexachloropropene	SV	SW846-8270C	5	ug/l	170	ug/kg
193-39-5	Indeno(1,2,3-cd)pyrene	SV	SW846-8270C	5	ug/l	170	ug/kg
78-59-1	Isophorone	SV	SW846-8270C	5	ug/l	170	ug/kg
120-58-1	Isosafrole	SV	SW846-8270C	5	ug/l	170	ug/kg
91-80-5	Methapyrilene	SV	SW846-8270C	5	ug/l	170	ug/kg
56-49-5	3-Methylcholanthrene	SV	SW846-8270C	5	ug/l	170	ug/kg
66-27-3	Methyl methanesulfonate	SV	SW846-8270C	5	ug/l	170	ug/kg
91-57-6	2-Methylnaphthalene	SV	SW846-8270C	5	ug/l	170	ug/kg
95-48-7	2-Methylphenol (o-Cresol)	SV	SW846-8270C	5	ug/l	170	ug/kg
108-39-4	3-Methylphenol ((m-Cresol)	SV	SW846-8270C	5	ug/l	170	ug/kg
106-44-5	4-Methylphenol (p-Cresol)	SV	SW846-8270C	5	ug/l	170	ug/kg
298-00-0	Methyl parathion	SV	SW846-8270C	5	ug/l	170	ug/kg
91-20-3	Naphthalene	SV	SW846-8270C	5	ug/l	170	ug/kg
130-15-4	1,4-Naphthoquinone	SV	SW846-8270C	5	ug/l	170	ug/kg
134-32-7	1-Naphthylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
91-59-8	2-Naphthylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
88-74-4	2-Nitroaniline	SV	SW846-8270C	10	ug/l	330	ug/kg
99-09-2	3-Nitroaniline	SV	SW846-8270C	10	ug/l	330	ug/kg
100-01-6	4-Nitroaniline	SV	SW846-8270C	10	ug/l	330	ug/kg

Table 5-1
RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED

Page 4 of 6

CAS#	Analyte Name	Type	Project Quantitation Limits				
			Method	Aqueous	Units	Soil *	Units
98-95-3	Nitrobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
56-57-5	4-Nitroquinoline-1-oxide	SV	SW846-8270C	5	ug/l	170	ug/kg
88-75-5	2-Nitrophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
100-02-7	4-Nitrophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
55-18-5	N-Nitrosodiethylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
62-75-9	N-Nitrosodimethylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
86-30-6	N-Nitrosodiphenylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
621-64-7	N-Nitrosodi-n-propylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
924-16-3	N-Nitrosodi-n-butylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
10595-95-6	N-Nitrosomethylethylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
59-89-2	N-Nitrosomorpholine	SV	SW846-8270C	5	ug/l	170	ug/kg
100-75-4	N-Nitrosopiperidenemethylethylamine	SV	SW846-8270C	5	ug/l	170	ug/kg
930-55-2	N-Nitrosopyrrolidine	SV	SW846-8270C	5	ug/l	170	ug/kg
99-55-8	5-Nitro-0-toluidine	SV	SW846-8270C	5	ug/l	170	ug/kg
56-38-2	Parathion	SV	SW846-8270C	5	ug/l	170	ug/kg
608-93-5	Pentachlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
76-01-7	Pentachloroethane	SV	SW846-8270C	5	ug/l	170	ug/kg
82-68-8	Pentachloronitrobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
87-86-5	Pentachlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
62-44-2	Phenacetin	SV	SW846-8270C	5	ug/l	170	ug/kg
85-01-8	Phenanthrene	SV	SW846-8270C	5	ug/l	170	ug/kg
108-95-2	Phenol	SV	SW846-8270C	5	ug/l	170	ug/kg
106-50-3	p-Phenylenediamine	SV	SW846-8270C	100	ug/l	3300	ug/kg
298-02-2	Phorate	SV	SW846-8270C	5	ug/l	170	ug/kg
109-06-8	2-Picoline	SV	SW846-8270C	5	ug/l	170	ug/kg
23950-58-5	Pronamide	SV	SW846-8270C	5	ug/l	170	ug/kg
129-00-0	Pyrene	SV	SW846-8270C	5	ug/l	170	ug/kg
110-86-1	Pyridine	SV	SW846-8270C	5	ug/l	170	ug/kg
94-59-7	Safrole	SV	SW846-8270C	5	ug/l	170	ug/kg
3689-24-5	Sulfotepp	SV	SW846-8270C	5	ug/l	170	ug/kg
95-94-3	1,2,4,5-Tetrachlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
58-90-2	2,3,4,6-Tetrachlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
95-53-4	0-Toluidine	SV	SW846-8270C	5	ug/l	170	ug/kg
120-82-1	1,2,4-Trichlorobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
95-95-4	2,4,5-Trichlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
88-06-2	2,4,6-Trichlorophenol	SV	SW846-8270C	5	ug/l	170	ug/kg
126-68-1	0,0,0-Triethylphosphorothioate	SV	SW846-8270C	5	ug/l	170	ug/kg
99-35-4	1,3,5-Trinitrobenzene	SV	SW846-8270C	5	ug/l	170	ug/kg
12674-11-2	Aroclor-1016	PCB	SW846-8082	0.4	ug/l	13	ug/kg
11104-28-2	Aroclor-1221	PCB	SW846-8082	0.4	ug/l	13	ug/kg
11141-16-5	Aroclor-1232	PCB	SW846-8082	0.4	ug/l	13	ug/kg
53469-21-9	Aroclor-1242	PCB	SW846-8082	0.4	ug/l	13	ug/kg
12672-29-6	Aroclor-1248	PCB	SW846-8082	0.4	ug/l	13	ug/kg
11097-69-1	Aroclor-1254	PCB	SW846-8082	0.4	ug/l	13	ug/kg
11096-82-5	Aroclor-1260	PCB	SW846-8082	0.4	ug/l	13	ug/kg

Table 5-1

**RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED**

Page 5 of 6

CAS#	Analyte Name	Type	Project Quantitation Limits				
			Method	Aqueous	Units	Soil *	Units
57-74-9	Chlordane (TCLP)	OP	SW846-8081A	2	ug/l	2	ug/l
72-20-8	Endrin (TCLP)	OP	SW846-8081A	0.4	ug/l	0.4	ug/l
76-44-8	Heptachlor (TCLP)	OP	SW846-8081A	0.4	ug/l	0.4	ug/l
1024-57-3	Heptachlor Epoxide (TCLP)	OP	SW846-8081A	0.4	ug/l	0.4	ug/l
58-89-9	Lindane (TCLP)	OP	SW846-8081A	0.4	ug/l	0.4	ug/l
72-43-5	Methoxychlor (TCLP)	OP	SW846-8081A	0.4	ug/l	0.4	ug/l
8001-35-2	Toxaphene (TCLP)	OP	SW846-8081A	0.2	ug/l	0.2	ug/l
94-75-7	2,4-D (TCLP)	H	SW846-8151A	20	ug/l	20	ug/l
	2,4,5-TP (Silvex) (TCLP)	H	SW846-8151A	20	ug/l	20	ug/l
7440-38-2	Arsenic	M	SW846-7000A	2.0	ug/l	0.10	mg/kg
7440-39-3	Barium	M	SW846-6010B	10.0	ug/l	0.50	mg/kg
7440-43-9	Cadmium	M	SW846-7000A	2.0	ug/l	0.10	mg/kg
7440-47-3	Chromium (total)	M	SW846-6010B	10.0	ug/l	0.50	mg/kg
7439-97-6	Mercury	M	SW846-7471A	0.20	ug/l	0.010	mg/kg
7439-92-1	Lead	M	SW846-7000A	2.0	ug/l	0.10	mg/kg
7440-22-4	Silver	M	SW846-6010B	2.0	ug/l	0.10	mg/kg
7782-49-2	Selenium	M	SW846-6010B-7000A	10.0/2.0	ug/l	0.5/0.1	mg/kg
7440-02-0	Nickel	M	SW846-6010B	10.0	ug/l	0.50	mg/kg
7440-66-6	Zinc	M	SW846-6010B	10.0	ug/l	0.50	mg/kg
7440-36-0	Antimony - SPLP/TCLP	M	1311/1312-6010B		N/A	0.20	mg/l
7440-38-2	Arsenic - SPLP/TCLP	M	1311/1312-7000A		N/A	0.10	mg/l
7440-39-3	Barium - SPLP/TCLP	M	1311/1312-6010B		N/A	0.010	mg/l
7440-41-7	Beryllium - SPLP/TCLP	M	1311/1312-6010B		N/A	0.002	mg/l
7440-43-9	Cadmium - SPLP/TCLP	M	1311/1312-6010B		N/A	0.010	mg/l
7440-47-3	Chromium (total) - SPLP/TCLP	M	1311/1312-6010B		N/A	0.025	mg/l
7440-50-8	Copper - SPLP/TCLP	M	1311/1312-6010B		N/A	0.025	mg/l
7439-92-1	Lead - SPLP/TCLP	M	1311/1312-7000A		N/A	0.050	mg/l
7439-97-6	Mercury - SPLP/TCLP	M	1311/1312-7471		N/A	0.0002	mg/l
7440-02-0	Nickel - SPLP/TCLP	M	1311/1312-6010B		N/A	0.025	mg/l
7782-49-2	Selenium - SPLP/TCLP	M	1311/1312-7000A		N/A	0.10	mg/l
7440-22-4	Silver - SPLP/TCLP	M	1311/1312-6010B		N/A	0.010	mg/l
7440-28-0	Thallium SPLP/TCLP	M	1311/1312-7000A		N/A	0.20	mg/l
7440-62-2	Vanadium - SPLP/TCLP	M	1311/1312-6010B		N/A	0.050	mg/l
7440-66-6	Zinc - SPLP/TCLP	M	1311/1312-6010B		N/A	0.050	mg/l
5289290-40-1	Total Petroleum Hydrocarbons	Phy	418.1	0.4	mg/l	100	mg/kg
	Total Petroleum Hydrocarbons	Phy	CT ETPH	0.1	mg/l	3.3	mg/kg
SA0001	Alkalinity (to pH 8.3)	WC	EPA 310.1	1.0	mg/l		mg/kg
SA0002	Total Alkalinity (to pH 4.5)	WC	EPA 310.1	1.0	mg/l		mg/kg
SA0003	Ammonia	WC	EPA 350.2	0.020	mg/l	5.0	mg/kg
SA0004	BOD	WC	EPA 405.1	2.0	mg/l		mg/kg

Table 5-1

**RECOMMENDED PROJECT SPECIFIC PRACTICAL QUANTITATION LIMITS FOR CONSTITUENTS
FOR WHICH ANALYSIS MAY BE CONDUCTED**

Page 6 of 6

CAS#	Analyte Name	Type	Project Quantitation Limits				
			Method	Aqueous	Units	Soil *	Units
SA0006	Chloride	WC	EPA 300.0	2.0	mg/l		mg/kg
SA0007	COD	WC	EPA 410.2	2.0	mg/l		mg/kg
SA0008	Cyanide, Total	WC	SW846 9012	0.010	mg/l	0.25	mg/kg
SA0011	Hexavalent Chromium	WC	SW846 7196A	0.050	mg/l		mg/kg
SA0012	Nitrate/Nitrite	WC	EPA 300.0	0.10	mg/l		mg/kg
SA0014	Orthophosphate	WC	EPA 365.3	0.020	mg/l		mg/kg
SA0018	Total Dissolved Solids	WC	EPA 160.1	1.0	mg/l		mg/kg
SA0019	Total Organic Carbon	WC	EPA 415.1/Kahn	1.0	mg/l		mg/kg
SA0023	Total Sulfate	WC	EPA 300.0	1.0	mg/l		mg/kg
SA0024	Total Suspended Solids	WC	EPA 160.2	1.0	mg/l		mg/kg

NOTES:

(1) Fractions: VOA (Volatile Organic), DAI (Direct Aqueous Injection), SV (Semivolatile Organic), PCB (Polychlorinated biphenyls)

OP (Organophosphorus Pesticide), H (Herbicide), M (Metal), Phy (Physical), and

WC (Wet Chemistry Parameter)

(2) Fictitious CAS number created to represent the coeluting isomers 3-methylphenol and 4-methylphenol.

(3) These are recommended quantitation limits. The final Practical Quantitation limits will be at a concentration to comply with the appropriate Connecticut Remedial Standard Regulations criteria or the selected laboratory's lowest reporting limit, whichever is lower.

SW-846 - "Test Methods for Evaluating Solid Waste, Physical Chemical Methods," third edition.

EPA - "Methods for Chemical Analysis of Water and Wastes," EPA 600 4/79-020

CT-ETPH - "Analysis of Extractable Petroleum hydrocarbons (ETPH) Using Methylene Chloride Gas Chromatograph/Flame Ionization Detector"

analysis the medium level soil PQL's are 50 times higher than the aqueous limits

Table 5-2
RECOMMENDED ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

Page 1 of 4

Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
TCL Volatile Compounds	Lab blank, trip blank, or field blank	All TCL Compounds	<5X the QL or methylene chloride, and <QL for all other compounds	<5X the QL or methylene chloride, and <QL for all other compounds
	Matrix Spike Duplicate Precision	All TCL Compounds	Table 5-3	Table 5-3
	Matrix Spike Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Laboratory Control Sample Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Surrogate Spike Recoveries	4-Bromofluorobenzene Dibromofluoromethane Toluene-d8 Dichloroethane-d4	86-115% 86-118% 88-110% 80-120%	74-121% 80-120% 81-117% 80-120%
TCL Semivolatile Compounds	Lab blank, trip blank, or field blank	All TCL Compounds	<QL for all compounds	<QL for all compounds
	Matrix Spike Duplicate Precision	All TCL Compounds	Table 5-3	Table 5-3
	Matrix Spike Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Laboratory Control Sample Recovery	All TCL Compounds	Table 5-3	Table 5-3

Table 5-2
RECOMMENDED ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

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Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
	Surrogate Spike Recoveries	Nitrobenzene-d5 2-Fluorobiphenyl p-Terphenyl-d14 Phenol-d6 Phenol-d5 2-Fluorophenol 2,4,6-Tribromophenol 4,4-Dibromobiphenyl (Spiked onto cartridge before it is sent to the field.)	35-114% 43-116% 33-141% 10-94% 10-115% 21-100% 10-123% NA	23-120% 30-115% 18-137% 24-113% 24-113% 25-121% 19-121% NA

Table 5-2
RECOMMENDED ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

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Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
TCL Pesticides/ PCB Compounds	Lab blank, trip blank, or field blank	All TCL Compounds	<QL for all compounds	<QL for all compounds
	Matrix Spike Duplicate Precision	All TCL Compounds	Table 5-3	Table 5-3
	Matrix Spike Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Laboratory Control Sample Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Surrogate Spike Recoveries	Tetrachloror-meta-xylene decachlorobiphenyl	60-150% 60-150%	60-150% 60-150%
RCRA 8 Metals plus nickel and zinc	Lab blank, trip blank, or field blank	All TCL Compounds	<PRDL for all compounds	<PRDL for all compounds
	Laboratory Duplicate Precision	All TCL Compounds	Table 5-3	Table 5-3
	Matrix Spike Recovery	All TCL Compounds	Table 5-3	Table 5-3
	Laboratory Control Sample Recovery	All Metals	Table 5-3	Table 5-3
All Wet Chemistry Parameters	Lab blank, trip blank, or field blank	All Parameters	<QL for all compounds	<QL for all compounds
	Laboratory Duplicate Precision	All Parameters	Table 5-3	Table 5-3
	Matrix Spike Recovery	All Parameters	Table 5-3	Table 5-3
	Laboratory Control Sample Recovery	All Parameters	Table 5-3	Table 5-3

Table 5-2
RECOMMENDED ACCURACY AND PRECISION DATA QUALITY OBJECTIVES

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Parameter	Audit	Compounds	Aqueous Control Limits	Solid Control Limits
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Notes:

QL = Quantitation limit; PRDL = Project required detection Limit; TCL = TargetCompound List; NA= Not Applicable

VOC and SVOC surrogate recoveries updated to reflect most current method specifications on 5/5/01

Table 5-3
RECOMMENDED MATRIX SPIKE AND LABORATORY CONTROL SAMPLE
PRECISION AND ACCURACY OBJECTIVES

Page 1 of 5

CAS#	Analyte Name	Aqueous			Solid/Soil		
		MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery	MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery
67-64-1	Acetone	36-132	15	36-132	33-138	40	33-138
71-43-2	Benzene	50-150	15	50-150	42-167	40	42-167
75-27-4	Bromodichloromethane	19-146	15	19-146	45-453	40	45-453
75-25-2	Bromoform	29-141	15	29-141	42-153	40	42-153
74-83-9	Methyl bromide	13-174	15	13-174	34-164	40	34-164
78-93-3	Methyl ethyl ketone	35-153	15	35-153	46-146	40	46-146
75-15-0	Carbon disulfide	14-171	15	14-171	39-153	40	39-153
56-23-5	Carbon tetrachloride	52-151	15	52-151	42-168	40	42-168
108-90-7	Chlorobenzene	54-149	15	54-149	43-164	40	43-164
75-00-3	Chloroethane	16-167	15	16-167	31-160	40	31-160
67-66-3	Chloroform	56-152	15	56-152	46-160	40	46-160
74-87-3	Methyl chloride	30-170	15	30-170	25-175	40	25-175
124-48-1	Chlorodibromomethane	33-150	15	33-150	44-151	40	44-151
75-34-3	1,1-Dichloroethene	36-166	15	36-166	44-164	40	44-164
107-06-2	1,2-Dichloroethene	52-149	15	52-149	46-160	40	46-160
75-35-4	1,1-Dichloroethane	22-181	15	22-181	52-166	40	52-166
540-59-0	1,2-Dichloroethane (total)	53-149	15	53-149	43-167	40	43-167
78-87-5	1,2-Dichloropropane	36-164	15	36-164	46-163	40	46-163
10061-01-5	cis-1,3-Dichloropropene	47-140	15	47-140	45-153	40	45-153
10061-02-6	trans-1,3-dichloropropene	27-143	15	27-143	35-19	40	35-19
100-41-4	Ethylbenzene	54-157	15	54-157	45-172	40	45-172
591-78-6	Methyl butyl ketone	34-141	15	34-141	55-134	40	55-134
75-09-2	Methylene chloride	52-156	15	52-156	41-181	40	41-181
108-10-1	Methyl isobutyl ketone	45-119	15	45-119	54-128	40	54-128
100-42-5	Styrene	44-153	15	44-153	76-132	40	76-132
79-34-5	1,1,2,2-Tetrachloroethane	40-139	15	40-139	43-148	40	43-148
127-18-4	Tetrachloroethene	51-165	15	51-165	43-183	40	43-183
108-88-3	Toluene	49-156	15	49-156	44-170	40	44-170
71-55-6	1,1,1-Trichloroethane	1-144	15	1-144	45-166	40	45-166
79-00-5	1,1,2-Trichloroethane	48-142	15	48-142	44-156	40	44-156
79-01-6	Trichloroethene	36-159	15	36-159	42-169	40	42-169
75-01-4	Vinyl chloride	38-168	15	38-168	31-176	40	31-176
1330-20-7	Xylenes (total)	52-150	15	52-150	42-162	40	42-162

Table 5-3
RECOMMENDED MATRIX SPIKE AND LABORATORY CONTROL SAMPLE
PRECISION AND ACCURACY OBJECTIVES

Page 2 of 5

CAS#	Analyte Name	Aqueous			Solid/Soil		
		MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery	MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery
83-32-9	Acenaphthene	58-108	20	58-108	46-117	40	46-117
208-96-8	Acenaphthylene	50-112	20	50-112	43-116	40	43-116
120-12-7	Anthracene	59-104	20	59-104	41-121	40	41-121
56-55-3	Benzo[a]anthracene	61-111	20	61-111	48-124	40	48-124
205-99-2	Benzo[b]fluoranthene	55-114	20	55-114	40-134	40	40-134
207-08-9	Benzo[k]fluoranthene	50-126	20	50-126	41-134	40	41-134
191-24-2	Benzo[ghi]perylene	57-137	20	57-137	35-147	40	35-147
50-32-8	Benzo[a]pyrene	48-123	20	48-123	42-137	40	42-137
111-91-1	bis(2-Chloroethoxy)methane	47-109	20	47-109	41-117	40	41-117
111-44-4	bis(2-Chloroethyl)ether	53-102	20	53-102	39-116	40	39-116
108-60-1	bis(2-Chloroisopropyl)ether	42-117	20	42-117	65-108	40	65-108
117-81-7	bis(2-Ethylhexyl)phthalate	55-122	20	55-122	45-132	40	45-132
101-55-3	4-Bromophenyl phenyl ether	60-106	20	60-106	46-123	40	46-123
85-68-7	Butyl benzyl phthalate	49-119	20	49-119	48-135	40	48-135
106-47-8	4-Chloroaniline	49-99	20	49-99	D.L.-123	40	D.L.-123
59-50-7	4-Chloro-3-methylphenol	58-111	20	58-111	48-117	40	48-117
91-58-7	2-Chloronaphthalene	55-105	20	55-105	45-117	40	45-117
95-57-8	2-Chlorophenol	56-101	20	56-101	43-114	40	43-114
7005-72-3	4-Chlorophenyl phenyl ether	54-108	20	54-108	49-117	40	49-117
218-01-9	Chrysene	58-115	20	58-115	48-12+6	40	48-12+6
132-64-9	Dibenzofuran	55-113	20	55-113	67-103	40	67-103
84-74-2	Di-n-butyl phthalate	54-115	20	54-115	43-126	40	43-126
53-70-3	Dibenz[a,h]anthracene	50-146	20	50-146	45-154	40	45-154
95-50-1	1,2-Dichlorobenzene	47-98	20	47-98	39-112	40	39-112
541-73-1	1,3-Dichlorobenzene	43-94	20	43-94	37-112	40	37-112
106-46-7	1,4-Dichlorobenzene	43-94	20	43-94	39-110	40	39-110
91-94-1	3,3-Dichlorobenzidine	52-112	20	52-112	19-117	40	19-117
120-83-2	2,4-Dichlorophenol	56-105	20	56-105	46-117	40	46-117
84-66-2	Diethyl phthalate	48-115	20	48-115	49-127	40	49-127
105-67-9	2,4-Dimethylphenol	52-94	20	52-94	33-113	40	33-113
131-11-3	Dimethyl phthalate	25-106	20	25-106	49-123	40	49-123

Table 5-3
RECOMMENDED MATRIX SPIKE AND LABORATORY CONTROL SAMPLE
PRECISION AND ACCURACY OBJECTIVES

Page 3 of 5

CAS#	Analyte Name	Aqueous			Solid/Soil		
		MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery	MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery
534-52-1	4,6-Dinitro-2-methylphenol	53-117	20	53-117	28-147	40	28-147
51-28-5	2,4-Dinitrophenol	43-131	20	43-131	9-167	40	9-167
121-14-2	2,4-Dinitrotoluene	56-118	20	56-118	48-126	40	48-126
606-20-2	2,6-Dinitrotoluene	56-106	20	56-106	47-122	40	47-122
117-84-0	Di-n-octyl phthalate	44-140	20	44-140	35-150	40	35-150
206-44-0	Fluoranthene	53-115	20	53-115	44-121	40	44-121
86-73-7	Fluorene	51-113	20	51-113	46-115	40	46-115
118-74-1	Hexachlorobenzene	63-108	20	63-108	44-126	40	44-126
87-68-3	Hexachlorobutadiene	30-85	20	30-85	41-117	40	41-117
77-47-4	Hexachlorocyclopentadiene	D.L.-132	20	D.L.-132	D.L.-125	40	D.L.-125
67-72-1	Hexachloroethane	35-83	20	35-83	39-110	40	39-110
193-39-5	Indeno(1,2,3-cd)pyrene	48-141	20	48-141	44-151	40	44-151
78-59-1	Isophorone	54-106	20	54-106	41-115	40	41-115
91-57-6	2-Methylnaphthalene	49-104	20	49-104	61-99	40	61-99
95-48-7	2-Methylphenol	47-87	20	47-87	58-114	40	58-114
91-20-3	Naphthalene	50-108	20	50-108	41-115	40	41-115
88-74-4	2-Nitroaniline	59-112	20	59-112	74-102	40	74-102
99-09-2	3-Nitroaniline	50-114	20	50-114	47-105	40	47-105
100-01-6	4-Nitroaniline	54-126	20	54-126	37-108	40	37-108
98-95-3	Nitrobenzene	54-106	20	54-106	42-116	40	42-116
88-75-5	2-Nitrophenol	65-112	20	65-112	44-122	40	44-122
100-02-7	4-Nitrophenol	17-68	20	17-68	42-146	40	42-146
86-30-6	N-Nitrosodiphenylamine	33-70	20	33-70	39-125	40	39-125
621-64-7	N-Nitrosodipropylamine	51-112	20	51-112	40-120	40	40-120
87-86-5	Pentachlorophenol	29-135	20	29-135	18-161	40	18-161
85-01-8	Phenanthrene	60-109	20	60-109	43-121	40	43-121
108-95-2	Phenol	28-58	20	28-58	36-121	40	36-121
129-00-0	Pyrene	58-118	20	58-118	46-130	40	46-130
120-82-1	1,2,4-Trichlorobenzene	45-100	20	45-100	42-114	40	42-114
95-95-4	2,4,5-Trichlorophenol	62-118	20	62-118	69-115	40	69-115
88-06-2	2,4,6-Trichlorophenol	50-108	20	50-108	46-118	40	46-118
86-74-8	Carbazole	40-137	20	40-137	35-133	40	35-133

Table 5-3
RECOMMENDED MATRIX SPIKE AND LABORATORY CONTROL SAMPLE
PRECISION AND ACCURACY OBJECTIVES

Page 4 of 5

CAS#	Analyte Name	Aqueous			Solid/Soil		
		MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery	MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery
58-89-9	gamma-BHC/Lindane (TCLP)	NA	NA	NA	10-130	60	15-135
5103-71-9	Chlordane (TCLP)	NA	NA	NA	12-148	68	30-143
72-20-8	Endrin (TCLP)	NA	NA	NA	10-156	73	17-162
76-44-8	Heptachlor (TCLP)	NA	NA	NA	10-125	58	16-136
1024-57-3	Heptachlor epoxide (TCLP)	NA	NA	NA	16-129	57	32-146
72-43-5	Methoxychlor (TCLP)	NA	NA	NA	10-170	80	18-180
94-75-7	2,4-D (TCLP)	NA	NA	NA	20-122	51	20-146
93-72-1	2,4,5-TP (TCLP)	NA	NA	NA	16-108	46	22-110
12674-11-2	Aroclor-1016	56-119	20	61-118	26-144	39	49-122
11096-82-5	Aroclor-1260	31-138	27	61-124	37-138	33	51-127
7440-38-2	Arsenic	75-125	20	75-125	75-125	20	75-125
7440-39-3	Barium	75-125	20	75-125	75-125	20	75-125
7440-43-9	Cadmium	75-125	20	75-125	75-125	20	75-125
7440-47-3	Chromium	75-125	20	75-125	75-125	20	75-125
7439-92-1	Lead	75-125	20	75-125	75-125	20	75-125
7439-97-6	Mercury	75-125	20	75-125	75-125	20	75-125
7440-02-0	Nickel	75-125	20	75-125	75-125	20	75-125
7440-22-4	Silver	75-125	20	75-125	75-125	20	75-125
7440-66-6	Zinc	75-125	20	75-125	75-125	20	75-125
SA0001	Alkalinity (to pH 8.3)	75-125	20	75-125	75-125	20	75-130
SA0002	Total Alkalinity (to pH 4.5)	75-125	20	75-125	75-125	20	75-130
SA0003	Ammonia	75-125	20	75-125	75-125	20	75-130
SA0004	BOD	75-125	20	75-125	75-125	20	75-130
SA0006	Chloride	75-125	20	75-125	75-125	20	75-130
SA0007	COD	75-125	20	75-125	75-125	20	75-130
SA0008	Cyanide, Total	75-125	20	75-125	75-125	20	75-130

Table 5-3
RECOMMENDED MATRIX SPIKE AND LABORATORY CONTROL SAMPLE
PRECISION AND ACCURACY OBJECTIVES

Page 5 of 5

CAS#	Analyte Name	Aqueous			Solid/Soil		
		MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery	MS/MSD % Recovery	MS/MSD or LD % RPD	LCS% Recovery
SA0011	Hexavalent Chromium	75-125	20	75-125	75-125	20	75-130
SA0012	Nitrate/Nitrite	75-125	20	75-125	75-125	20	75-130
SA0014	Orthophosphate	75-125	20	75-125	75-125	20	75-130
SA0018	Total Dissolved Solids	75-125	20	75-125	75-125	20	75-130
SA0019	Total Organic Carbon	75-125	20	75-125	75-125	20	75-130
SA0023	Total Sulfate	75-125	20	75-125	75-125	20	75-130
SA0024	Total Suspended Solids	75-125	20	75-125	75-125	20	75-130

NOTES:

(1) Fractions: VOA - Volatile Organic Analytes; DAI - Direct Aqueous Injection; SV - Semivolatile Organics; PCB - polychlorinated biphenyls

OP - Organophosphorus Pesticides; H - Herbicides; M - Metals; WC - Wet Chemistry; RAD - Radiological

(2) Fictitious CAS numbers created to represent the co-eluting isomers 3-methylphenol and 4-methylphenol.

(3) SVOC limits were rounded to whole numbers to reflect the accuracy of the laboratory (5/5/01).

SW-846 - "Test Methods for Evaluating Solid Waste, Physical Chemical Methods," third edition.

EPA - "Methods for Chemical Analysis of Water and Wastes," EPA 600-4/79-020.

(4) These are recommended values for recovery and RPD. The selected analytical laboratory's internal control limits will serve as the final limits for the project.

Table 5-4
Willow Brook and Willow Brook Pond
East Hartford, Connecticut

Quality Assurance Project Plan
Field Calibration Frequency

Equipment	Calibration Check	Calibration Standards	Initial Calibration Frequency
pH Meter	Prior to use-daily, Intermittently throughout the day At end the end of each day	pH 4.0 pH 7.0 pH 10.0	Initial Factory calibration And whenever calibration check no longer meets QC requirements
Dust Monitor	Prior to use-daily	Particle free environment	Initial Factory calibration And whenever calibration check no longer meets QC requirements
Conductivity Meter	Prior to use-daily	1,000 mg/l NaCl	Initial Factory calibration And whenever calibration check no longer meets QC requirements
Water Level Meter	Prior to use-daily	100' engineers' tape	Initial Factory calibration And whenever calibration check no longer meets QC requirements
Organic Vapor Meter	Prior to use-daily, Mid-day and/or following measurement spike and/or following percent drift greater than background	100 ppm Isobutylene	Initial Factory calibration And whenever calibration check no longer meets QC requirements
Turbidity Meter	Prior to use-daily	0.5 NTU	Initial Factory calibration And whenever calibration check no longer meets QC requirements
PCB Immunoassay	Per batch of samples (\leq 20 samples / batch)	1 ppm 10 ppm 25 ppm	Per batch of samples (\leq 20 samples / batch)

Notes:

1. N/A = not applicable.
2. NTU= nephelometric turbidity units.
3. mg/l = milligrams per liter.
4. ppm = parts per million.
5. Specific standard concentrations are selected based on the objective of the remedial activity.
6. Intermittent calibration checks: will be performed on field instrumentation whenever significant measurement spikes and / or percent differences greater than background are encountered. Intermittent calibration checks may also be performed when significant changes in temperature occur or other circumstances which may affect the performance of the instrumentation. Intermittent calibration checks will be documented in the field paperwork.

Table 5-5

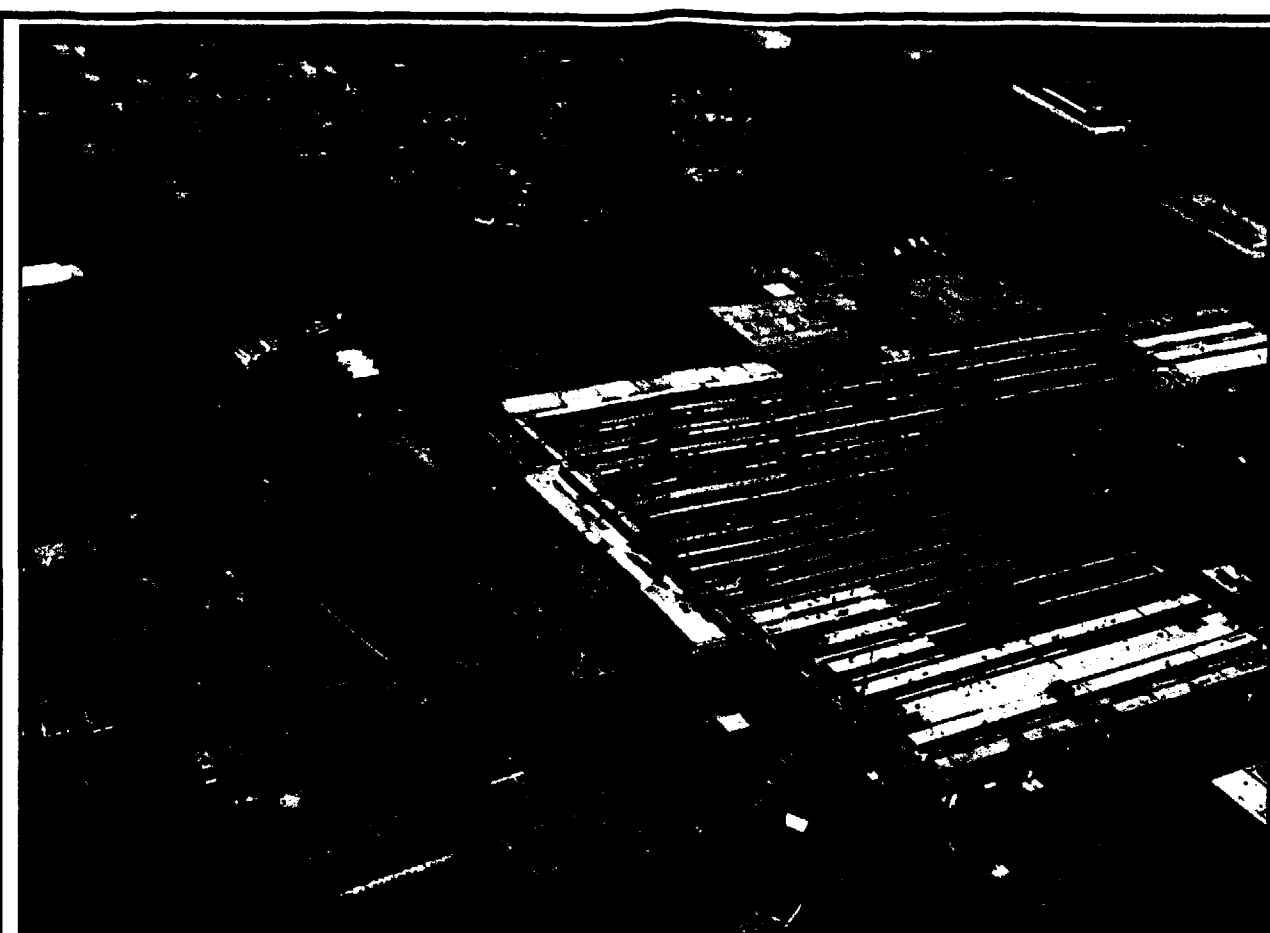
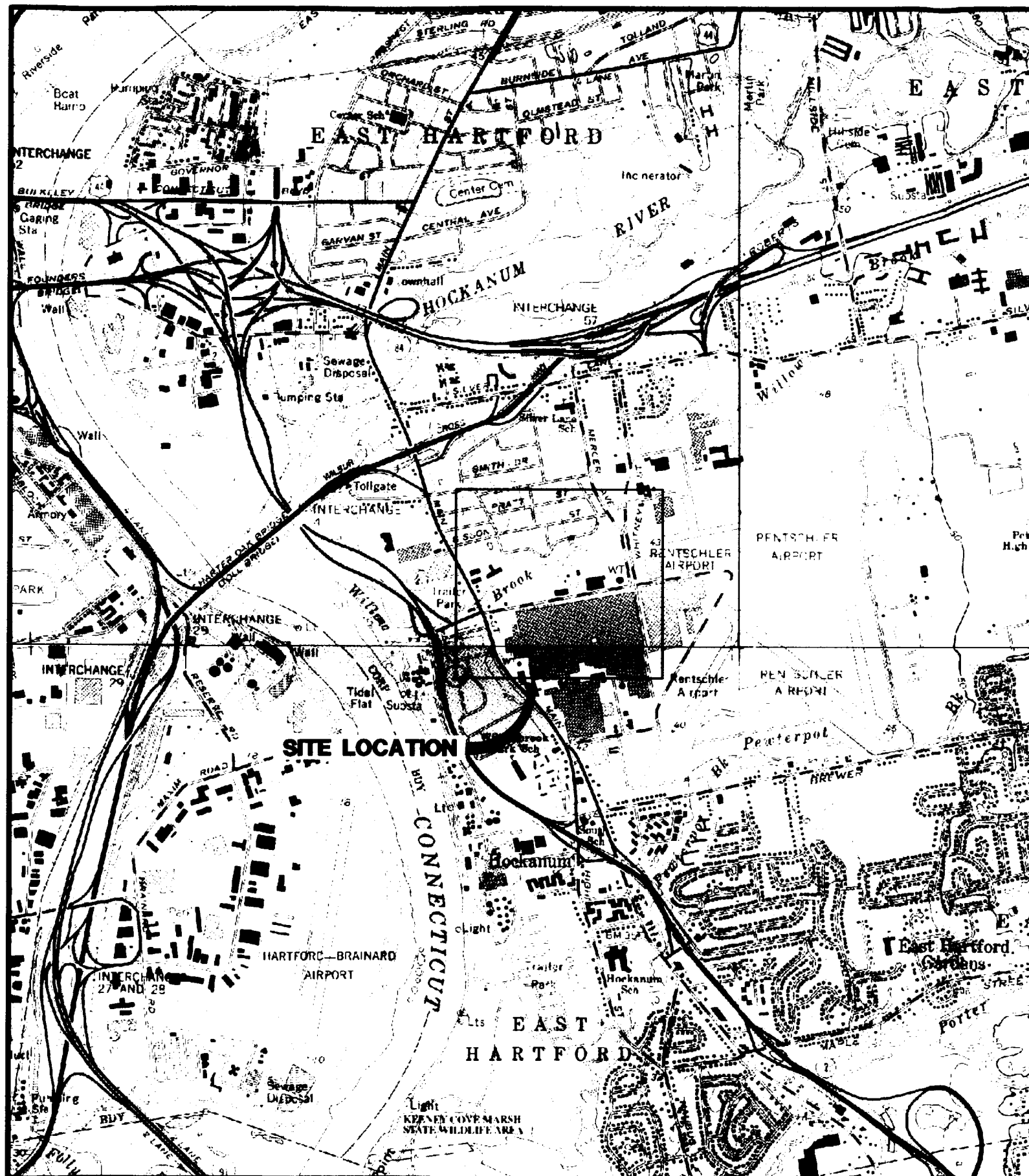
**Willow Brook and Willow Brook Pond
East Hartford, Connecticut**

**Quality Assurance Project Plan
Field Measurements Quality Control**

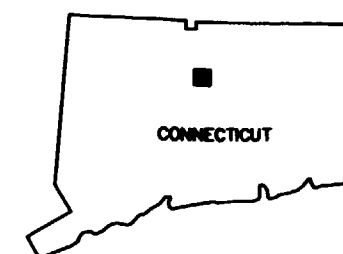
Field Parameter	Precision¹	Accuracy
Water Temperature	$\pm 1^{\circ} \text{C}$	$\pm 1^{\circ} \text{C}$ Instrument Capability
pH	$\pm 0.01 \text{ pH S.U.}$	$\pm 0.01 \text{ pH S.U.}$ (Instrument Capability)
Conductivity	$\pm 1 \mu\text{S}$	$\pm 1\%$ of Full Scale or ± 1 digit (greater of the values)
Dissolved Oxygen	$\pm 0.01 \text{ mg/L}$	$\pm 1\%$ of saturation
Turbidity	$\pm 1.0 \text{ NTU}$	$\pm 2\%$ Standard
Water Level	$\pm 0.01 \text{ foot}$	$\pm 0.01 \text{ foot}$
Dust Monitor	$\pm 10 \text{ ug/m}^3$ for 1-second averaging	$\pm 5\%$ of reading \pm precision
PCB Immunoassay Test Kit (semi-quantitative screening procedure)	NA	NA

Notes:

1. ¹ = Precision units presented in applicable significant figures.
2. S.U. = standard units
3. mS/cm = millisiemens per centimeter
4. mg/L = milligrams per liter
5. PCB immunoassay is a semi-quantitative method.



NOTE: AERIAL PHOTO TAKEN ON DECEMBER 30, 1999.



Originals in color.

REMEDIAL ACTION WORK PLAN
UTCVP & W. Willow Brook & Willow Brook Pond

SITE LOCATION MAP

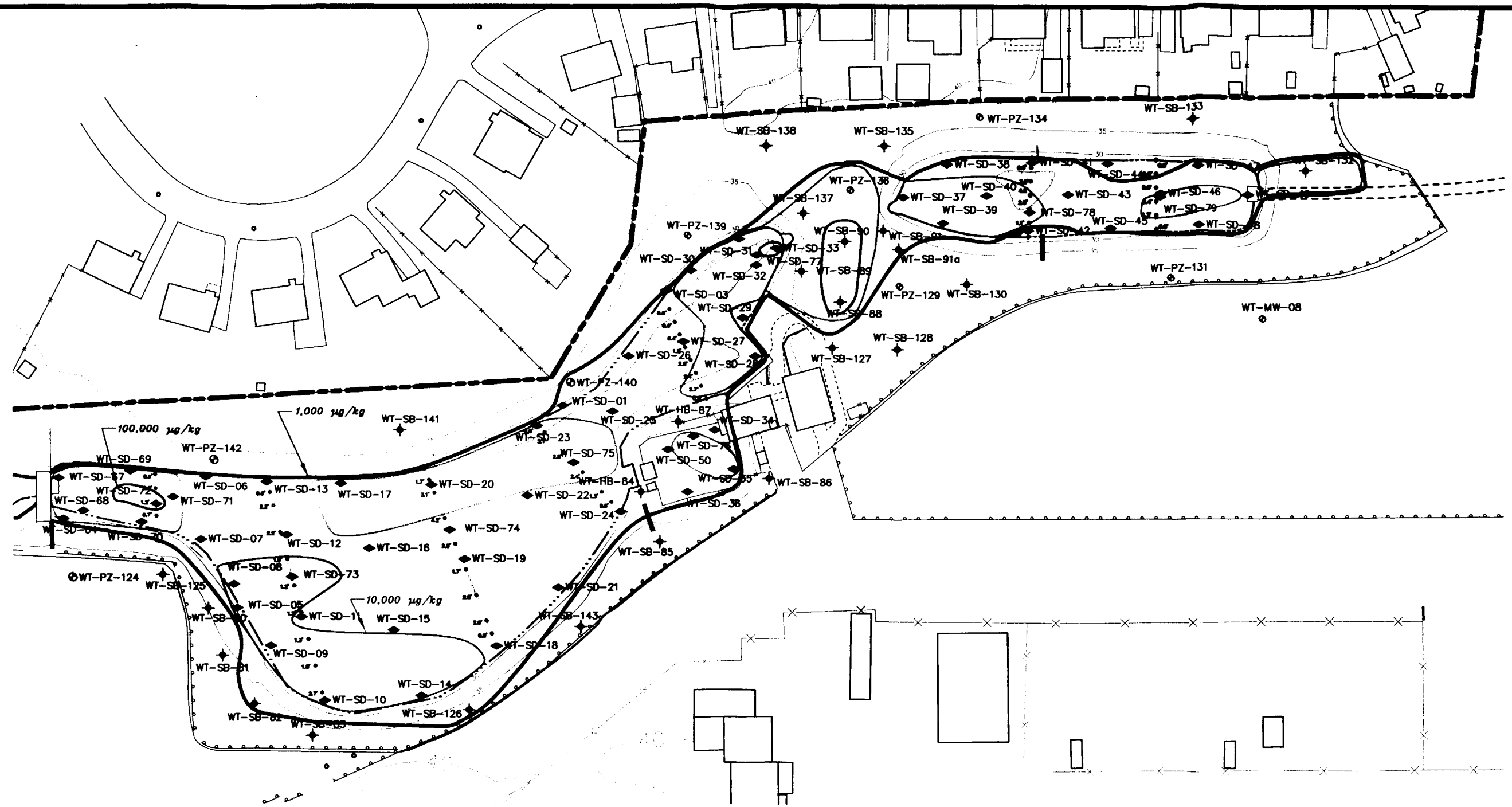
Comm.No.
88UT002

FIGURE 1-1



SOURCE: USGS 7.5 MIN. TOPOGRAPHIC QUADRANGLES: HARTFORD NORTH, CONN. 1964, HARTFORD SOUTH, CONN. 1964, MANCHESTER, CONN. 1963, AND GLASTONBURY, CONN. 1964. ALL PHOTOREVISED IN 1992.

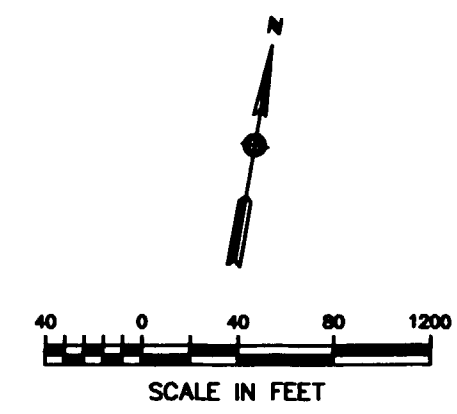
roughkey01-FIG1-1.dwg



Original includes color coding.

LEGEND

- | | | |
|------------------------|----------------------|--|
| ⊕ MONITORING WELL (MW) | ▲ SOIL SAMPLE (SS) | — TOTAL PCB's ISOCONCENTRATION CONTOUR (1000 µg/kg) |
| ⊕ SOIL BORING (SB) | ⊕ SURFACE GAUGE (SG) | — TOTAL PCB's ISOCONCENTRATION CONTOUR (10,000 µg/kg) |
| ◆ SEDIMENT SAMPLE | ⊕ PIEZOMETER (PZ) | — TOTAL PCB's ISOCONCENTRATION CONTOUR (100,000 µg/kg) |

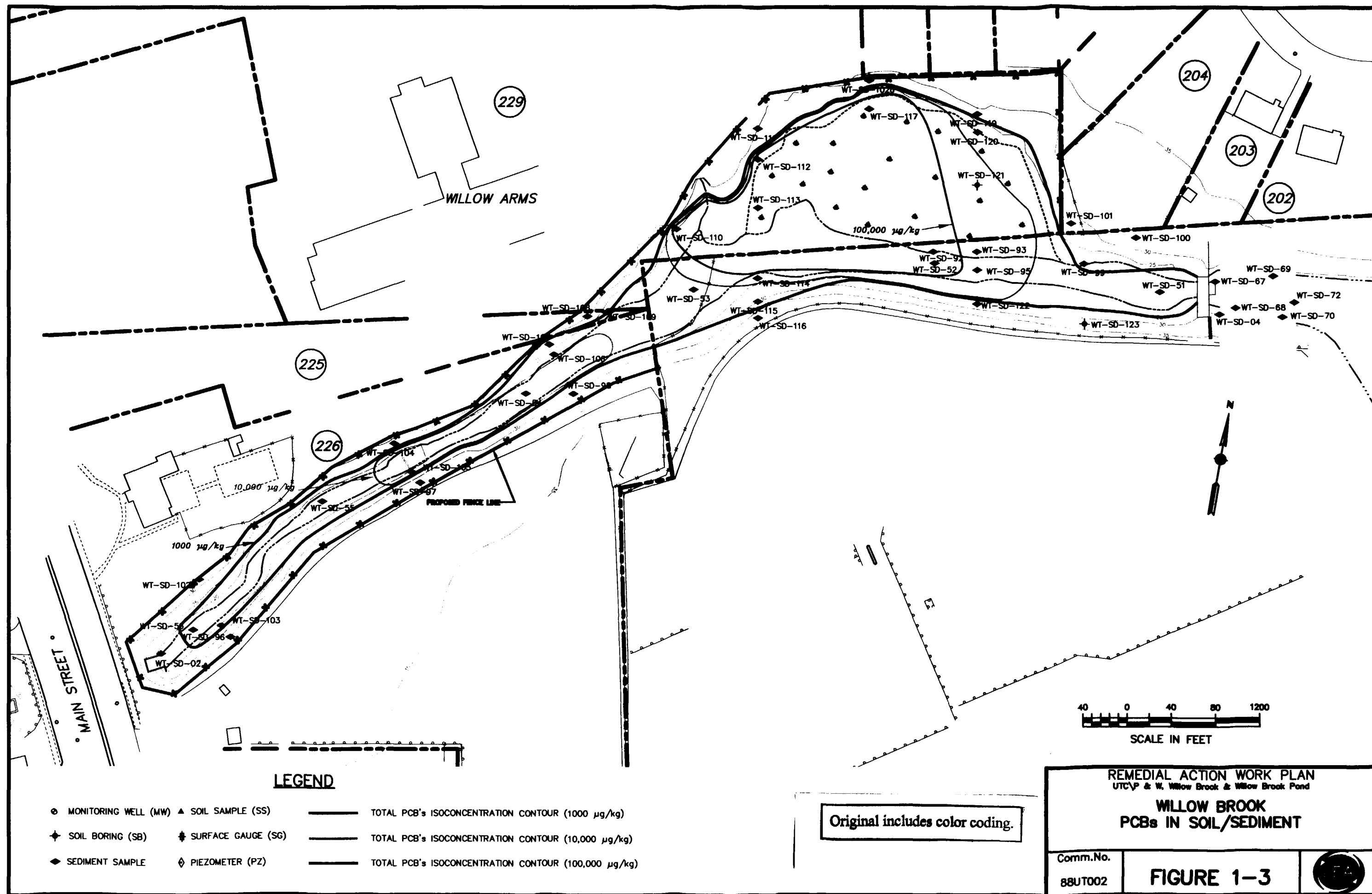


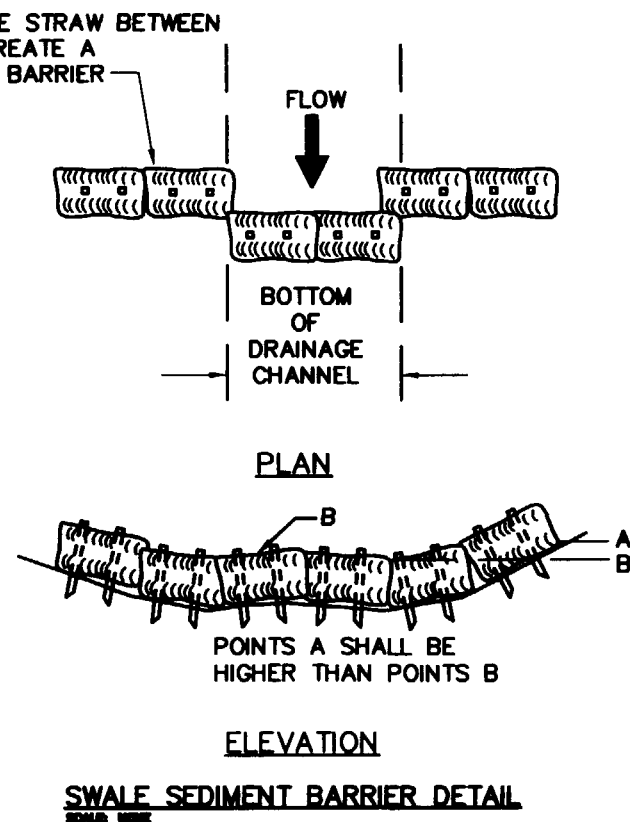
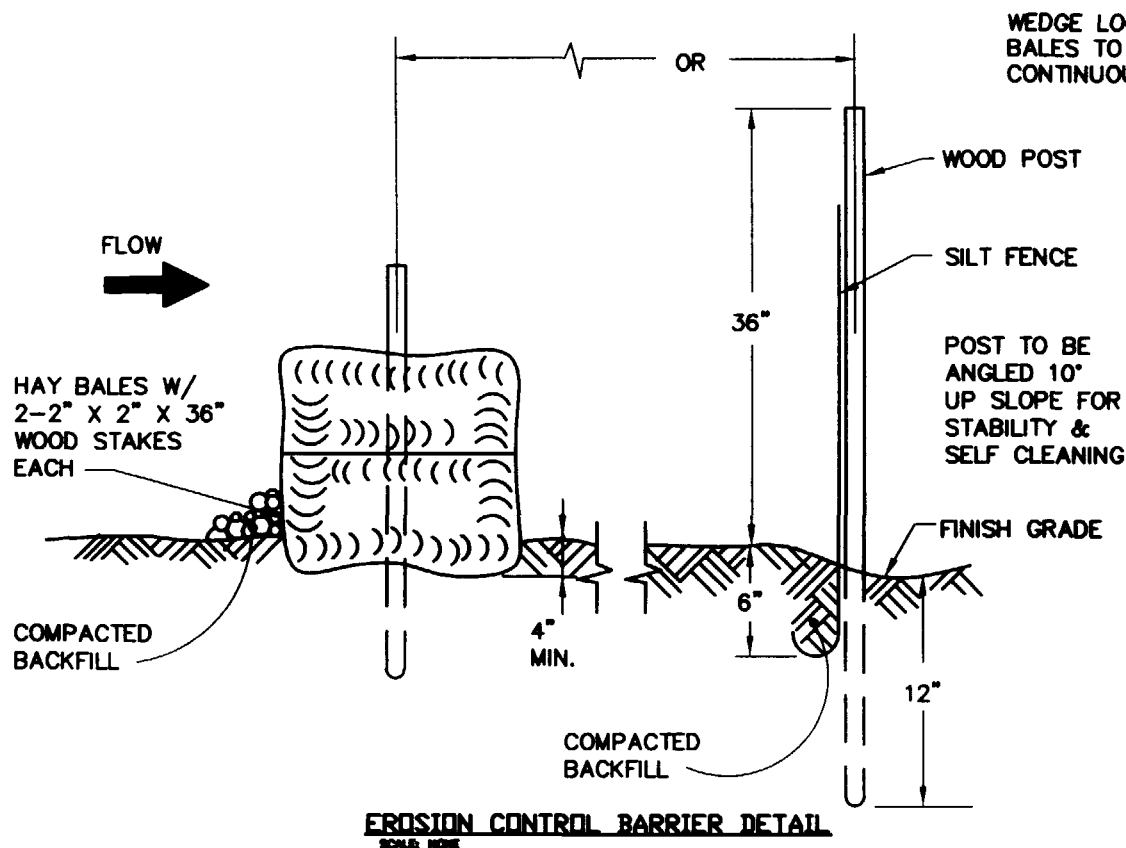
REMEDIAL ACTION WORK PLAN UTC/V & W, Willow Brook & Willow Brook Pond WILLOW BROOK POND PCBs IN SOIL/SEDIMENT

Comm.No.
88UT002

FIGURE 1-2







WHERE NEW CONSTRUCTION TAKES PLACE IN OR ADJACENT TO AN INLAND WETLANDS OR WATERCOURSE AREA, ALL NECESSARY PRECAUTIONS SHALL BE TAKEN TO AVOID DAMAGE TO THE NATURAL DRAINAGE AREAS AND INLAND WETLANDS. IN PARTICULAR, THE DISCHARGE OF SILT TO THE WETLANDS OR ANY WATER COURSE SHALL BE PREVENTED AND ALL APPLICABLE REGULATIONS OR REQUIREMENTS OF THE STATE DEPARTMENT OF ENVIRONMENTAL PROTECTION, THE DEPARTMENT OF THE ARMY AND TOWN ORDINANCES SHALL BE ADHERED TO INCLUDING THE PLACEMENT OF EROSION CONTROL AND SEDIMENT BARRIERS. WHEN THE CONSTRUCTION WORK IS COMPLETED, THE CONTRACTOR SHALL CLEAN AND RESTORE THE NATURAL DRAINAGE AREAS AFFECTED BY HIS OPERATIONS TO THEIR ORIGINAL CONDITION.

IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO MONITOR THE CONDITION OF THE EROSION CONTROL BARRIERS. IF THE EFFECTIVENESS OR INTEGRITY OF THE BARRIERS IS FOUND TO BE INSUFFICIENT OR IS DAMAGED IN ANY WAY, THE CONTRACTOR SHALL MAKE WHATEVER REPAIRS ARE NECESSARY TO ENSURE THAT PROPER EROSION CONTROL IS MAINTAINED. MONITORING OF THE EROSION CONTROL IS PARTICULARLY IMPORTANT IN THE AREAS WHERE EXCAVATION OR CONSTRUCTION IS TAKING PLACE OR FOLLOWING PERIODS OF RAINFALL. ALL REPAIRS TO THE EROSION CONTROL BARRIERS SHALL BE MADE BY THE CONTRACTOR AS SOON AS THE DAMAGE IS DISCOVERED.

REMEDIAL ACTION WORK PLAN

UTC/P & W, Willow Brook & Willow Brook Pond

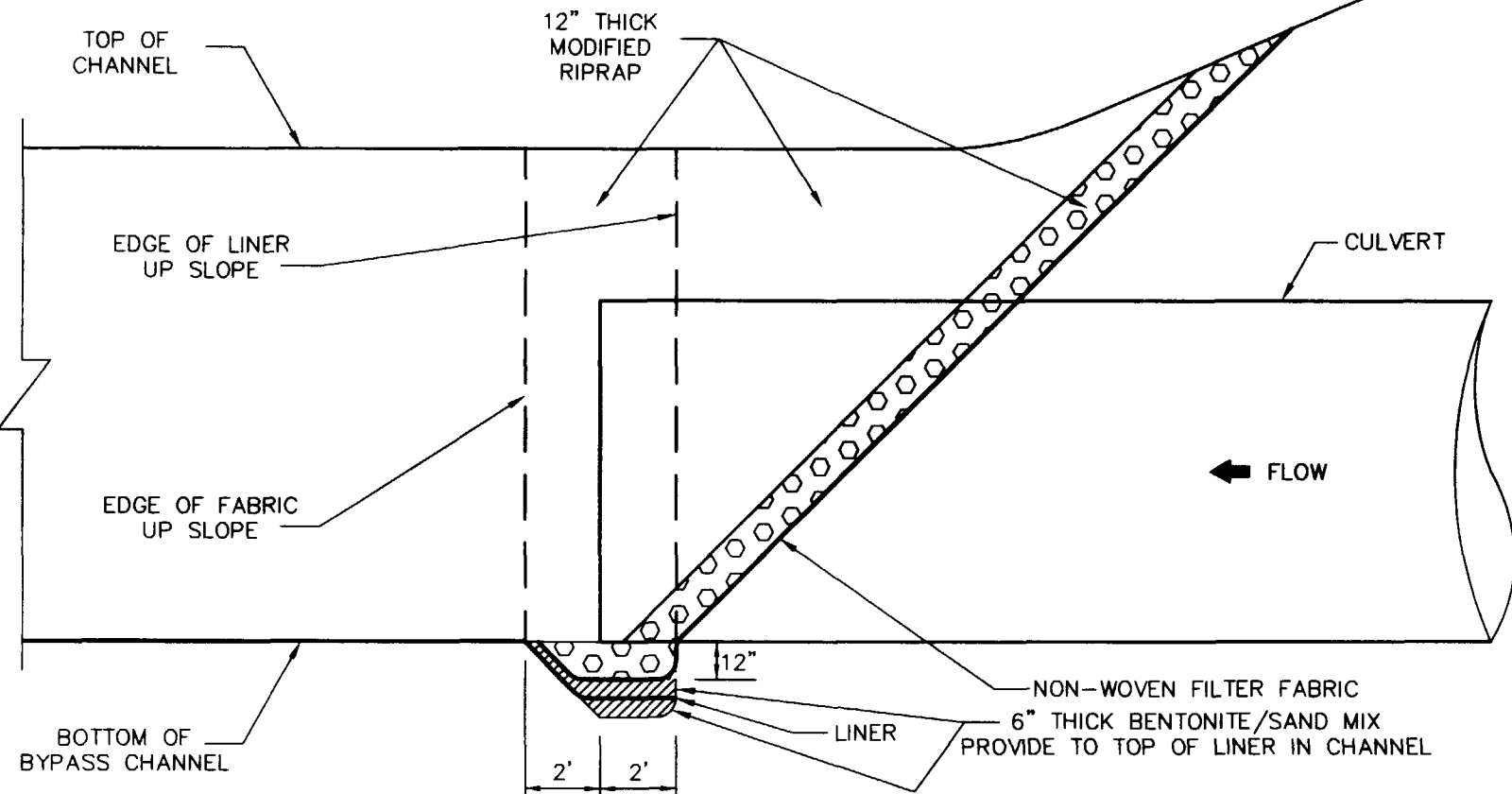
DETAIL - EROSION CONTROLS

Comm.No.

88UT002

FIGURE 2-1





REMEDIAL ACTION WORK PLAN
UTC/P & W, Willow Brook & Willow Brook Pond

**DETAIL –
CULVERT TRANSITION AT
BYPASS CHANNEL**

Comm.No.

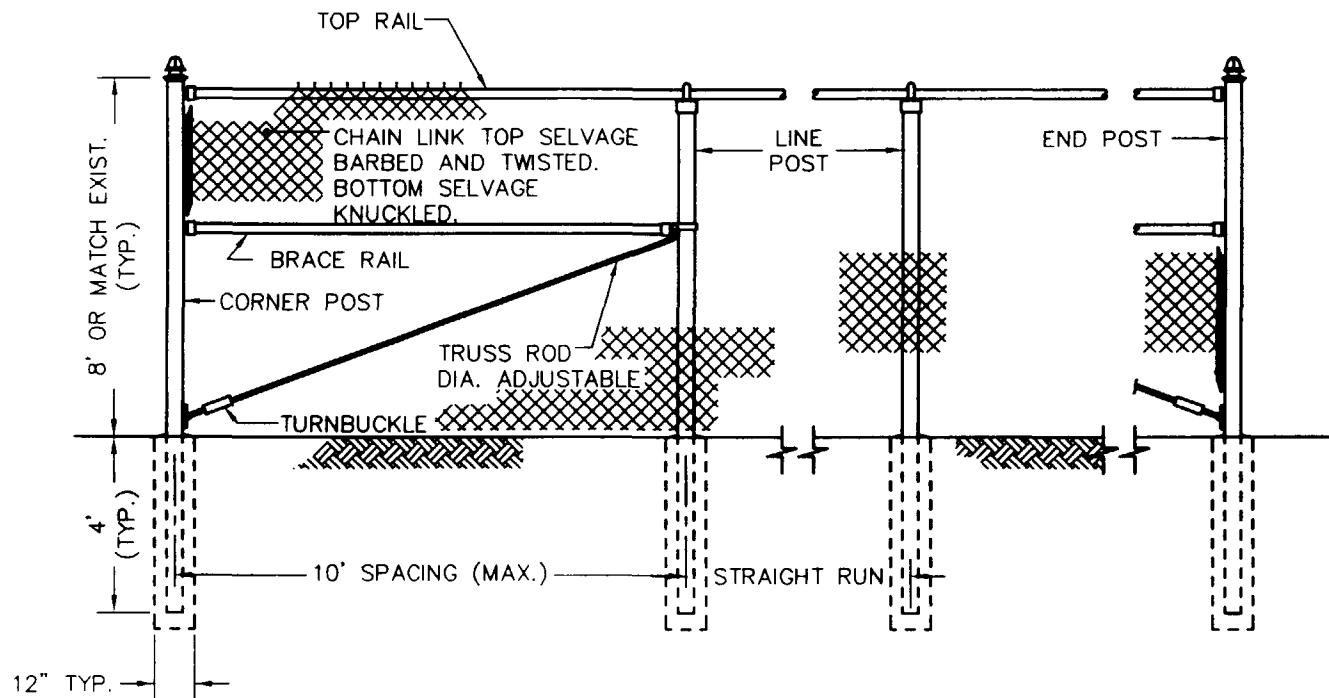
88UT002

FIGURE 2-2



NOT TO SCALE

rawp-DET-Bypass.dwg



NOT TO SCALE

REMEDIAL ACTION WORK PLAN
UTC/P & W, Willow Brook & Willow Brook Pond

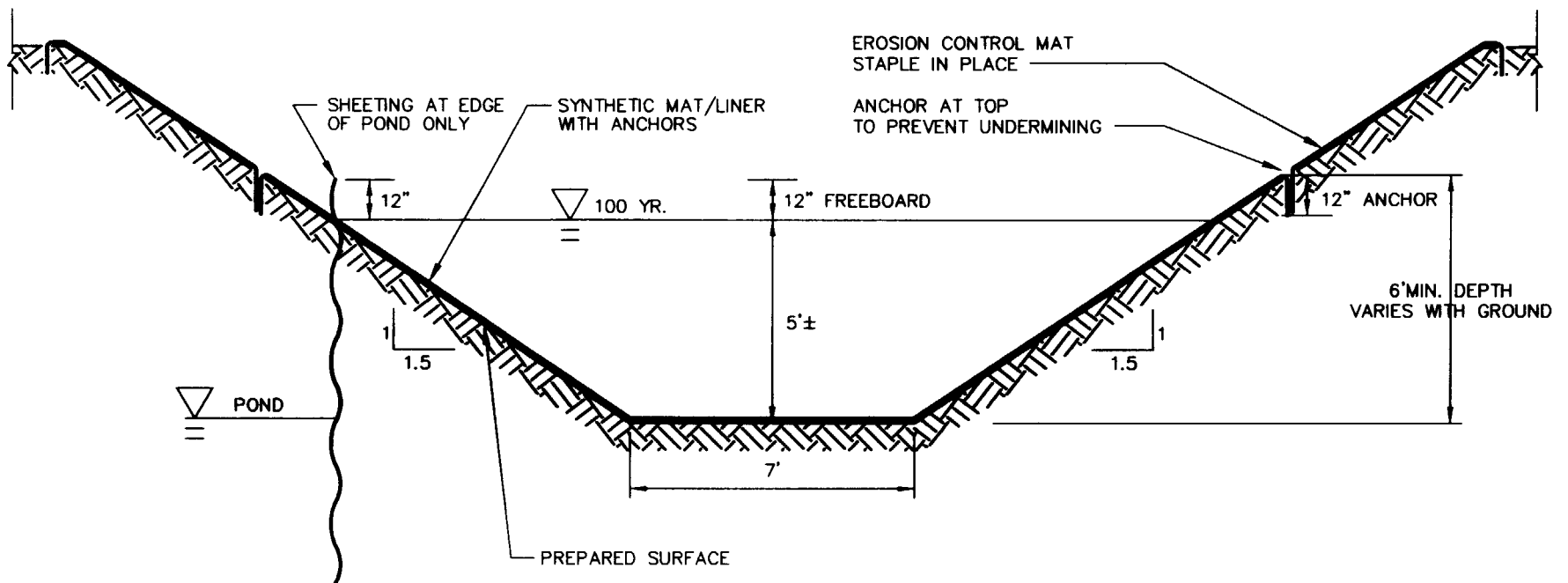
DETAIL - CHAIN LINK FENCE

Comm.No.

88UT002

FIGURE 2-3





REMEDIAL ACTION WORK PLAN
UTC/P & W. Willow Brook & Willow Brook Pond

DETAIL - BYPASS CHANNEL

Comm.No.

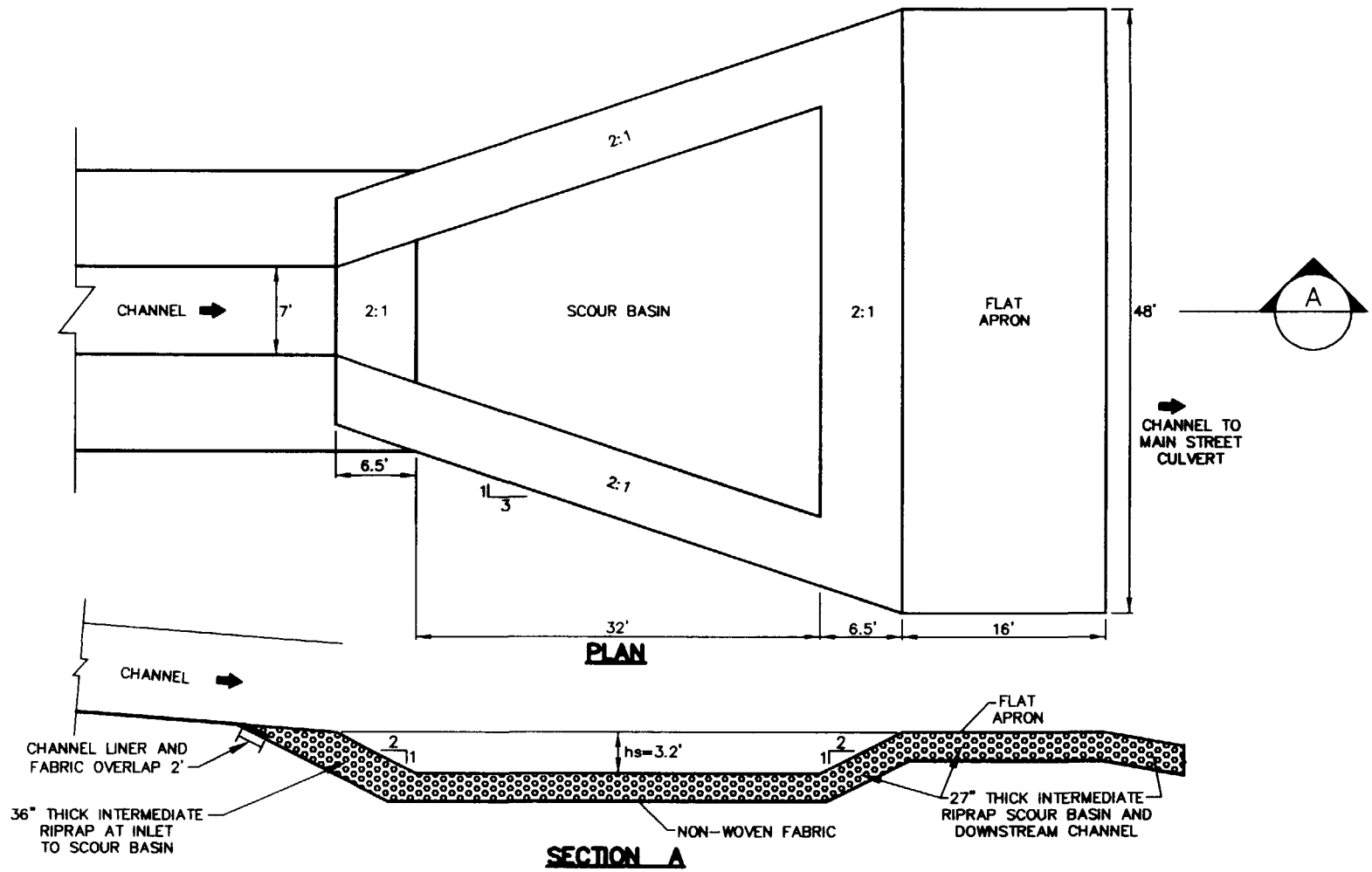
88UT002

FIGURE 2-4



NOT TO SCALE

rowp-DET-Bypass.dwg



REMEDIAL ACTION WORK PLAN
UTC\P & W, Willow Brook & Willow Brook Pond

DETAIL -
BYPASS CHANNEL
ENERGY DISSIPATER

Comm.No.
88UT002

FIGURE 2-5



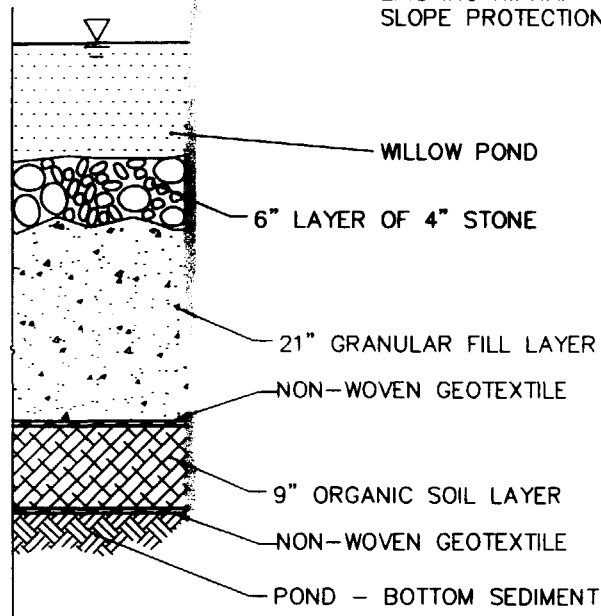
NOT TO SCALE

EXISTING POND SIDE WALL
STRUCTURE TO REMAIN
(WOOD, GUARD RAIL OR
SHEET PILE)



EXISTING SLOPE w/HABITAT
PLANTINGS AS PER PLAN

EXISTING RIPRAP
SLOPE PROTECTION



LOWER POND

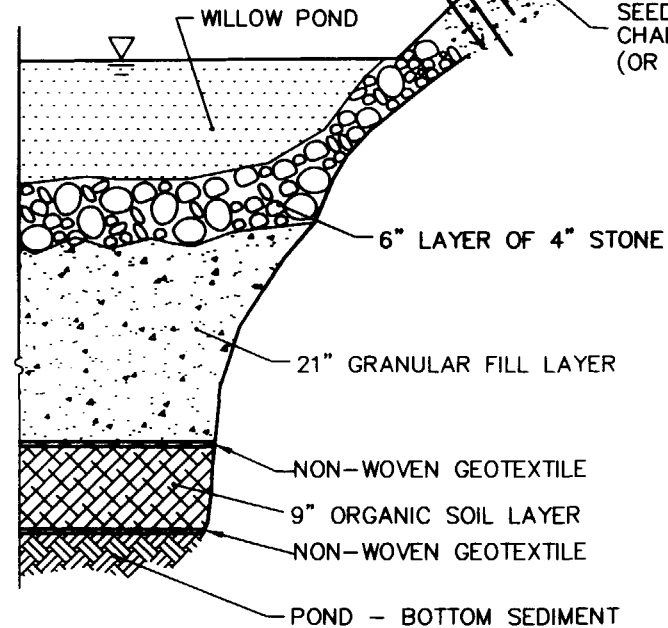
NOT TO SCALE

LIVE WILLOW STAKES

SHRUBS & SMALL TREES
INSTALLED IN POCKETS

1.5'

SEEDED ENKAMAT®
CHANNEL LINING
(OR APPROVED EQUAL)



UPPER POND

NOT TO SCALE

REMEDIAL ACTION WORK PLAN
UTC/P & W, Willow Brook & Willow Brook Pond

DETAIL - POND BOTTOM CAP

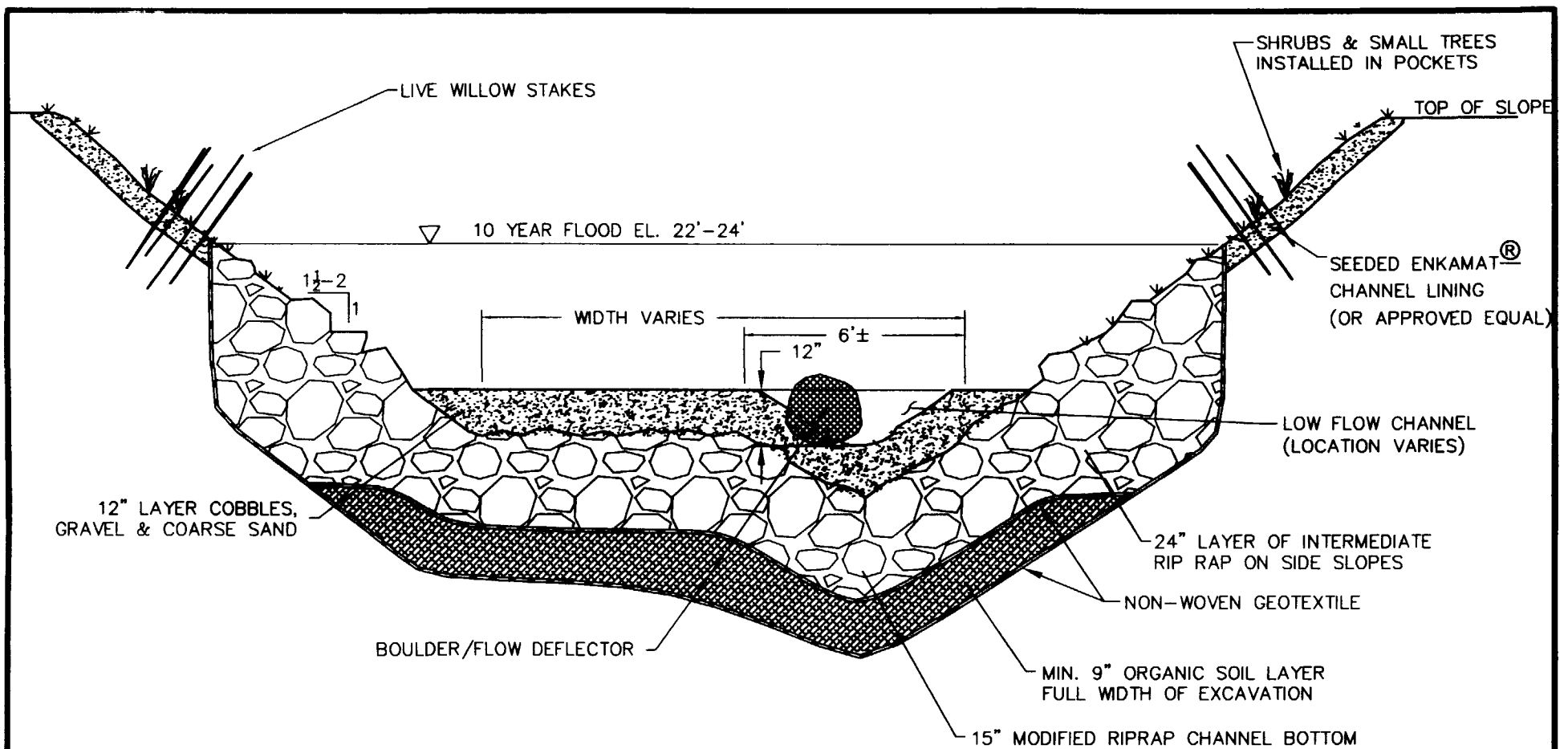
Comm.No.

88UT002

FIGURE 2-6



rawp-DETS.dwg



NOTE: BOULDERS OR FLOW DEFLECTORS SHALL BE NO WIDER THAN 20% OF THE STREAM WIDTH. THERE SHALL BE NO MORE THAN ONE BOULDER PER 300 FT² OF CHANNEL

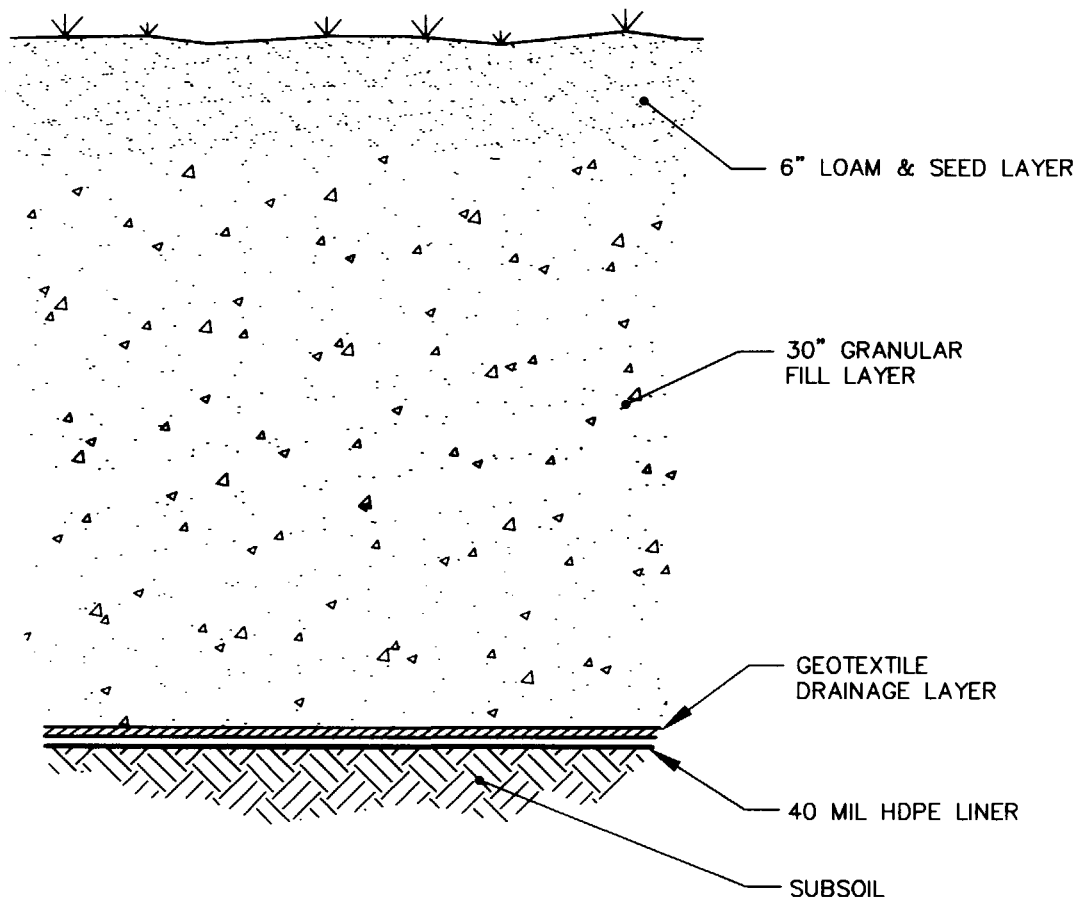
REMEDIAL ACTION WORK PLAN
UTC\P & W, Willow Brook & Willow Brook Pond

DETAIL - STREAM CHANNEL

Comm.No.
88UT002

FIGURE 2-7





NOT TO SCALE

REMEDIAL ACTION WORK PLAN
UTC/P & W, Willow Brook & Willow Brook Pond

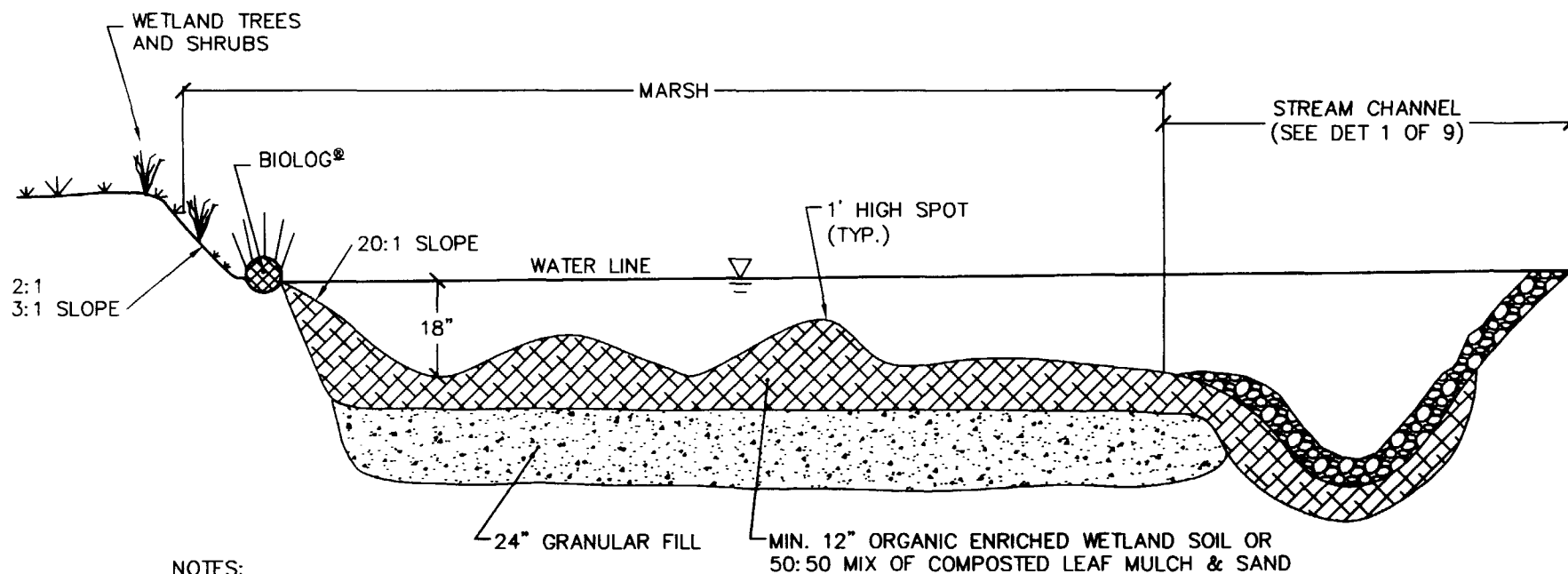
DETAIL - COMPOSITE CAP

Comm.No.
88UT002

FIGURE 2-8



rwmp-DETS.dwg



NOTES:

- 1 PLANT 25% OF MARSH SURFACE WITH WETLAND HERBS AND EMERGENTS @ 2' O.C.
- 2 PLANT 25% OF WETLAND EDGE WITH TREES AND SHRUBS, 5' AVERAGE O.C., IN MASSES
- 3 PLANT BERM AND HIGH SPOTS WITH WETLAND SHRUBS.
- 4 PLANT BIOLOG® WITH WETLAND HERBS AT 1' O.C.
- 5 HIGH SPOTS TO BE 1'± ABOVE MARSH SURFACE.
- 6 SEED ALL EXPOSED WETLAND AREAS IN BLACKLEDGE RIVER NURSERY WETLAND SEED MIX (OR APPROVED EQUAL) AT 1lb/3000 ft²
- 7 SOIL SURFACE TO BE 6" – 18" BELOW WATER LEVEL OF STREAM.

N.T.S.

REMEDIAL ACTION WORK PLAN
UTC/P & W, Willow Brook & Willow Brook Pond

DETAIL – WETLAND RESTORATION

Comm.No.
88UT002





FIGURE 2-9









rawp-DETS.dwg

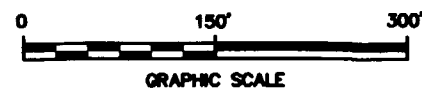
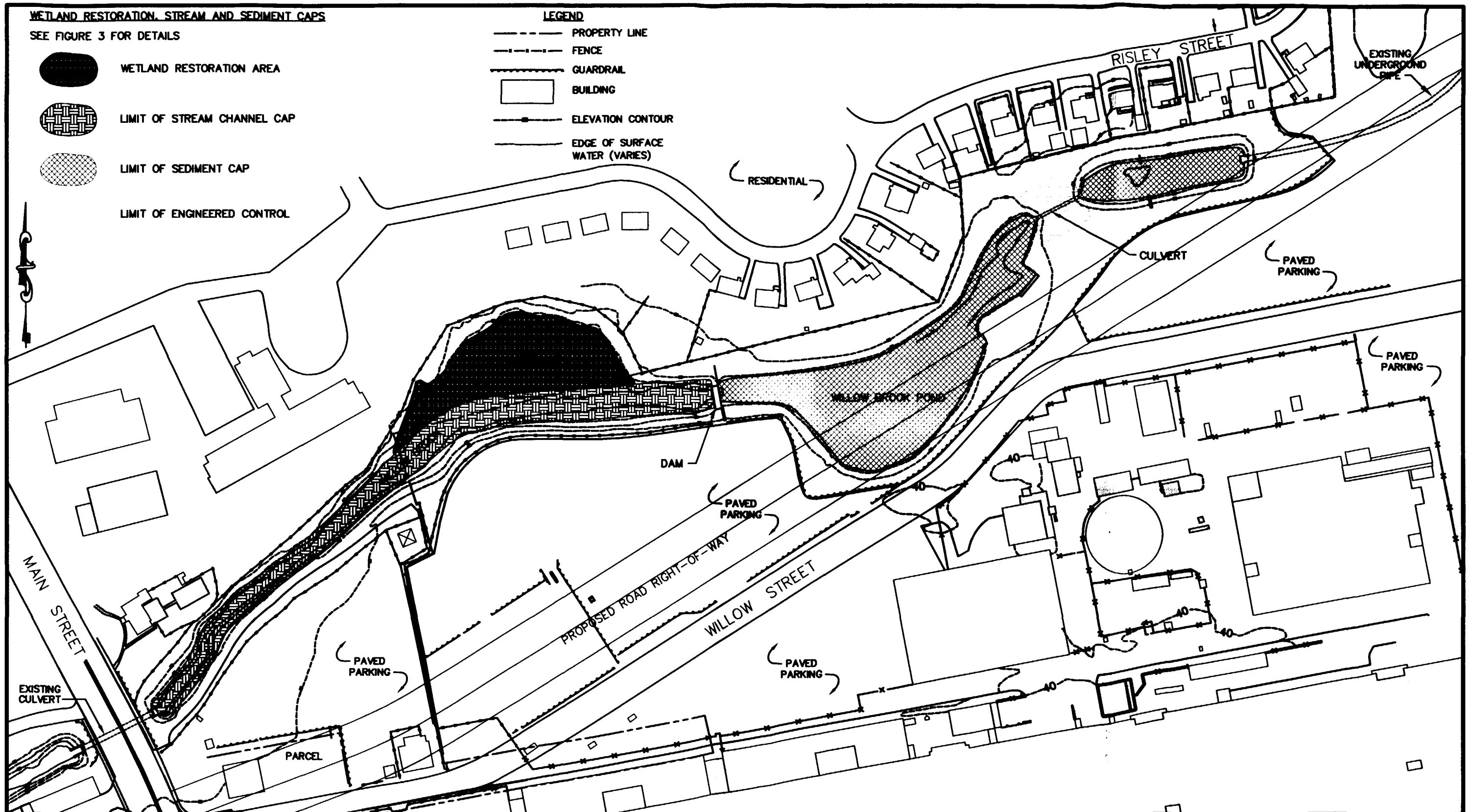
WETLAND RESTORATION, STREAM AND SEDIMENT CAPS

SEE FIGURE 3 FOR DETAILS

-  WETLAND RESTORATION AREA
-  LIMIT OF STREAM CHANNEL CAP
-  LIMIT OF SEDIMENT CAP
-  LIMIT OF ENGINEERED CONTROL

LEGEND

-  PROPERTY LINE
-  FENCE
-  GUARDRAIL
-  BUILDING
-  ELEVATION CONTOUR
-  EDGE OF SURFACE WATER (VARIES)



NOTES:

1. BASE MAP FROM ELECTRONIC FILE OF LOUREIRO ENGINEERING ASSOCIATES, P.C. DRAWING, DATED 12/1/96 AND FROM USGS AERIAL PHOTOGRAPHY, 1994.

Original includes color coding.

REMEDIAL ACTION WORK PLAN
UTC/P & W, Willow Brook & Willow Brook Pond

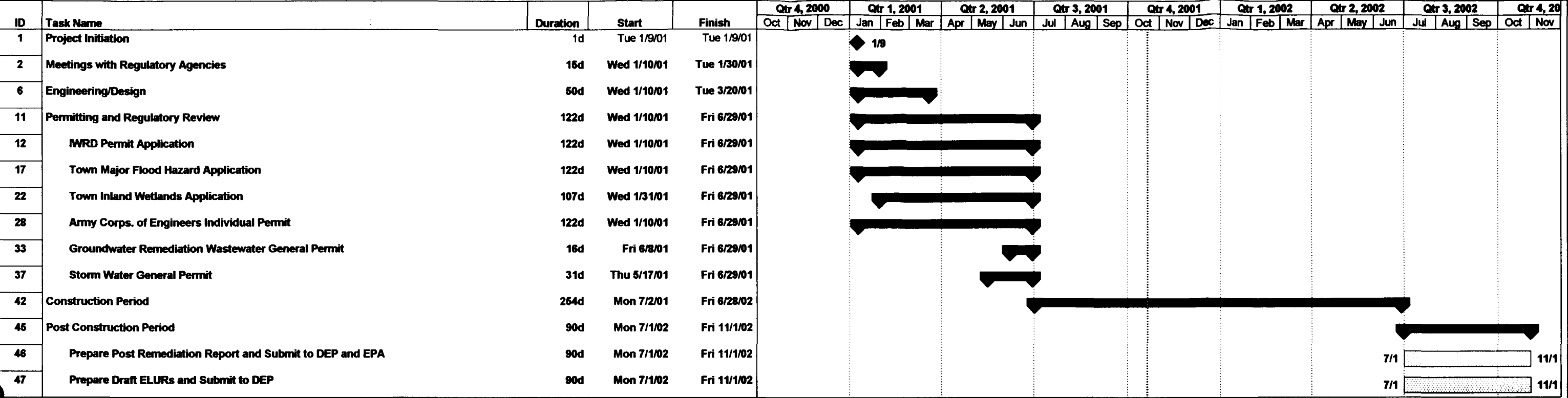
WILLOW STREET ROADWAY REALIGNMENT

Comm.No.
88UT002

FIGURE 2-10



Willow Brook/Willow Brook Pond
PCB Remediation Project
Project Schedule





Original includes color coding.

Project: Willow Brook Pond Remediation
Date: Sat 10/20/01

Task 
Critical Task 

Progress 
Milestone 

Summary 
Rolled Up Task 

Rolled Up Critical Task 
Rolled Up Milestone 

Rolled Up Progress 

Schedule Contingent Upon Receipt of Approvals from Town of East Hartford P&Z and Wetlands, ACOE, and DEP within timeframes stipulated.

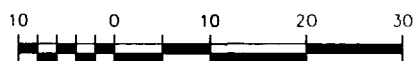
FIGURE 3-1



ONE COMPOSITE SAMPLE

20'

20'



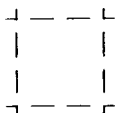
SCALE IN FEET



PROPOSED GRAB SOIL SAMPLE
OTHER COCs



PROPOSED GRAB SOIL SAMPLE
PCB ANALYSIS



SAMPLING GRID NODE

REMEDIAL ACTION WORK PLAN
UTC/P & W Willow Brook & Willow Brook Pond

PROPOSED SAMPLING GRID
(TYPICAL)

Comm.No.

88UT002

FIGURE 4-1



rawp-Mau01-FIG401.dwg

Sample ID 1973480
0000100 001
LEA
LEA VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973480
0000100 001
LEA
VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973481
0000100 001
LEA
VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973482
0000100 001
LEA
LEA VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973482
0000100 001
LEA
VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973482
0000100 001
LEA
Miscellaneous Analyses
Date: __/__/__ Time: __:__

Sample ID 1973483
0000100 001
LEA
VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973483
0000100 001
LEA
Miscellaneous Analyses
Date: __/__/__ Time: __:__

Sample ID 1973480
0000100 001
LEA
VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973481
0000100 001
LEA
LEA VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973481
0000100 001
LEA
VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973482
0000100 001
LEA
VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973482
0000100 001
LEA
LEA VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973483
0000100 001
LEA
LEA VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973483
0000100 001
LEA
VOC Scan
Date: __/__/__ Time: __:__

Sample ID 1973483
0000100 001
LEA
Miscellaneous Analyses
Date: __/__/__ Time: __:__

REMEDIAL ACTION WORK PLAN
UTC/P & W, Willow Brook & Willow Brook Pond

SAMPLE LABELS

Comm.No.
88UT002

FIGURE 4-2



rowpMay01FIG4-2345.dwg
Samp-label.pcx

No 145082

Custody Seal

DATE

SIGNATURE

No 145082

REMEDIAL ACTION WORK PLAN
UTC/P & W, Willow Brook & Willow Brook Pond

CUSTODY SEAL

Comm.No.
88UT002

FIGURE 4-3





Lounsbury Engineering Associates, Inc.
100 Northwest Drive, Plainville, CT 06062 (860) 747-6181

1973480002

Internal Chain of Custody/Sample Information Form

Project Name: _____ Sampling Method: _____
Project Location: _____ Matrix: Soil Vapor Water Other: _____
LEA Comm. No.: _____ Container Type: _____
Project Manager: _____ Sample Source: Monitoring Well / Vapor Probe / Vapor Extraction Well / Soil Boring / Other
Sampling Event Date: _____ Sampled By: _____

No.	Qty	Sample Number	Time	Mass (gm)	PID/FID Reading	Sample Class	Comments
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Signature	Time	Transfer Number	Item Number(s)	Relinquished By	Accepted By	Date	Time
		1					
		2					
		3					
		4					
Additional Comments		Sample Class Codes:					
		SB: soil - boring or pit - must include depths from ground or floor surface					
		SS: soil - surface - do not include depth					
		GW: ground water - must include depth from reference mark					
		SW: surface water					
Rev. By		WP: wipe					
Signature		VP: vapor probe					
Rev. By		BKE: equipment blank VBKE: vapor equipment blank					
		BKT: trip blank VBKT: vapor trip blank					
		BKF: field blank VBKF: vapor field blank					
		OT: other - describe in comments					

REMEDIAL ACTION WORK PLAN
UTC/P & W, Willow Brook & Willow Brook Pond

Comm.No.
88UT002

FIGURE 4-5



**US EPA New England
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RDMS Document ID# 1112

Facility Name: PRATT & WHITNEY (MAIN STREET)

Phase Classification: R-12

**Document Title: REMEDIAL ACTION WORK PLAN -
WILLOW BROOK AND WILLOW BROOK POND**

Date of Document: 10/01/2001

Document Type: WORK PLAN

Purpose of Target Sheet:

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Comments:

DRAWING 1-1: EXISTING SITE PLAN

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DRAWING 2-1: SITE PREPARATION

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Comments:

DRAWING 2-2: BY-PASS CHANNEL

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Date of Document: 10/01/2001

Document Type: WORK PLAN

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Below)

Comments:

DRAWING 2-3: SITE EXCAVATION

*** Please Contact the EPA New England RCRA Records Center to View This Document ***

**US EPA New England
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Image Target Sheet**

RDMS Document ID# 1112

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**Document Title: REMEDIAL ACTION WORK PLAN -
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Date of Document: 10/01/2001

Document Type: WORK PLAN

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Comments:

DRAWING 2-4: SITE RESTORATION

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Document Type: WORK PLAN

Purpose of Target Sheet:

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Comments:

DRAWING 2-5: CHANNEL IMPROVEMENTS

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Below)**

Comments:

**DRAWING 4-1: POTENTIAL CONFIRMATORY
SAMPLING LOCATIONS**

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Appendix A

Summary of Historical Analytical Results

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RDMS Document ID# 1112

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Document Type: WORK PLAN

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Comments:

**APPENDIX A, DRAWING 1: PCB DATA AND SAMPLING
LOCATIONS - WILLOW BROOK**

*** Please Contact the EPA New England RCRA Records Center to View This Document ***

**US EPA New England
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RDMS Document ID# 1112

Facility Name: PRATT & WHITNEY (MAIN STREET)

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**Document Title: REMEDIAL ACTION WORK PLAN -
WILLOW BROOK AND WILLOW BROOK POND**

Date of Document: 10/01/2001

Document Type: WORK PLAN

Purpose of Target Sheet:

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Comments:

**APPENDIX A, DRAWING 2: ANALYTICAL DATA AND
SAMPLING LOCATIONS - WILLOW BROOK POND**

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**APPENDIX A, DRAWING 3: ANALYTICAL DATA &
SAMPLING LOCATIONS - WILLOW BROOK**

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RDMS Document ID# 1112

Facility Name: PRATT & WHITNEY (MAIN STREET)

Phase Classification: R-12

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Document Type: WORK PLAN

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**APPENDIX A, DRAWING 4: GROUNDWATER DATA -
WILLOW POND**

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Appendix B

Standard Operating Procedures

**Standard Operating Procedure
for
Soil Sampling**

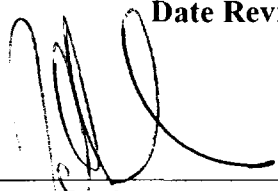
**Willow Brook and Willow Brook Pond
PCB Remediation**

SOP ID: 10006W

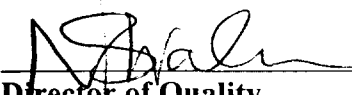
Date Initiated: 05/23/01

Date Revised: 08/31/01

Approved By: _____


Owner/Designee


Date


Director of Quality


Date

REVISION RECORD

<u>Rev #</u>	<u>Date</u>	<u>Additions/Deletions/Modifications</u>
Initial Issue	05/23/01	Initial Issue.
1	08/31/01	Added "resting period" for PCB Composite sample aliquots



**Standard Operating Procedure
for
Soil Sampling**

**Willow Brook and Willow Brook Pond
PCB Remediation**

1. Purpose and Scope

This document discusses procedures for collection of soil samples for analytical analysis. Methods for collection and quality assurance/quality control requirements are covered under separate standard operating procedures (SOPs). The procedures outlined in this document are in accordance with ASTM Standard D 420 and the EPA document Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846). These procedures may vary slightly according to the needs of specific projects.

2. Ownership and Approval

The President of LEA is the owner of this procedure. The owner or designee must approve this procedure and all revisions after review.

3. Definitions

3.1. Field Forms: For the purpose of document and data control, a form is a document used in the conduct of company business to capture data, including approvals where required. Completed forms providing objective evidence of quality related activities are retained as quality records.

4. Equipment and Equipment Documentation

4.1. Equipment required for the collection of soil samples shall include:

- stainless steel spatula or dedicated wood spatula
- decon solutions, including distilled water, 10 percent methanol, 10 percent nitric acid
- hand towels
- polyethylene plastic sheeting
- sample collection jars
- clean disposable gloves



- field documentation
- indelible marker
- cooler, cold packs
- chain of custody seals and sample labels
- polyethylene plastic sheeting (5 mil thickness)
- balance for weighing samples (for LEA laboratory samples, if needed)
- utility knife
- plastic bags
- Purge and Trap grade methanol or higher quality

4.2. Cleaning and Decontamination

- 4.2.1. Prior to collecting a soil sample, the LEA representative will ensure that all necessary sampling equipment is clean and decontaminated according to the procedure outlined in section 4.2.3 or according to the site specific work plan if different than below.
- 4.2.2. Upon completion of all sampling requirements and prior to leaving the site, all equipment used for sampling shall be cleaned and decontaminated according to the procedure outlined in section 4.2.3 or according to the site specific work plan if different than below. All generated decontamination fluids shall be disposed of in accordance with the site specific work plan and all municipal, state, and federal requirements.
- 4.2.3. The decontamination procedure of durable sampling equipment will be accomplished via cleaning the surfaces with a solvent as defined below. The order of decontamination is as follows:
- Detergent scrub
 - DI water rinse
 - Hexane rinse (to be used if separate-phase petroleum product, other than gasoline is present)
 - DI water rinse
 - 10 percent nitric acid rinse (to be used only when metals are suspected as potential contaminants)
 - DI water rinse
 - Methanol rinse (less than 10 percent solution)
 - Air dry

5. Sampling Protocols

5.1. Preliminary Sampling Procedures



5.1.1. Sample Bottles

5.1.1.1. A laboratory request form shall be completed and submitted to the laboratory with following information:

- project name
- LEA commission number
- date of submittal and date needed
- quantity of sample locations and sample points at each location
- type(s) of samples
- analytes, detection limits and QA/QC needed
- cooler(s) required
- number of chain of custody forms requested

5.1.1.2. Check bottles against laboratory request form for completeness. The bottles should also be checked for damage and cleanliness. Confirm with laboratory personnel the adequacy of the preservatives used.

5.1.1.3. The total number of sample sets shall be increased by 10 percent to allow for possible breakage during transport to sites or other contingencies (minimum: one additional sample bottle set per event).

5.1.1.4. Obtain preprinted labels and paperwork through the LEA information management system.

5.1.1.5. Label/date bottles in the field prior to sample collection. Check for accuracy.

5.1.1.6. A cooler with adequate ice or cold packs should be obtained from the laboratory to insure that the collected samples remain at 4 degrees Celsius during transport. Packing material should also be obtained to insure against breakage during transport.

5.1.2. Site Preparation

5.1.2.1. A level table shall be placed within the exclusion zone and covered with polyethylene sheeting.



- 5.1.2.2. Decontaminated or disposable spatulas shall be placed on the table. Sample bottles shall be placed in a convenient location and in order of sample collection.

5.2. General Sampling Procedures

- 5.2.1. All personal protective equipment (PPE) should be donned and maintained in accordance with the site specific work plan or health and safety plan during all sampling procedures. In the event that no PPE has been specified for a particular sampling event, disposable latex gloves should be donned, as a minimum, during all sampling procedures.
- 5.2.2. The particular soil sampling device (i.e. hand auger, split spoon, etc.) shall be retrieved from the point of collection and placed on a level table covered in polyethylene sheeting.
- 5.2.3. Using a decontaminated stainless steel spatula or dedicated wood spatula, the soil shall be transferred directly into prelabeled soil sampling containers. Refer to section 5.3 for details on VOC sample collection procedures with and without methanol preservation and section 5.4 for PCB Composite sample collection..
- 5.2.4. Wipe the rim of the sample container with a clean paper towel to remove excess solids which would prevent adequate sealing of the sample container and seal the container.

The order of sample collection shall be as follows:

- samples to be analyzed for volatile organic compounds at the LEA Analytical Laboratory
 - samples to be analyzed for volatile organic compounds using appropriate EPA methodologies
 - samples to be analyzed for other organic and inorganic constituents
- 5.2.5. As required, affix a custody seal, noting the date and time of collection across the cap/bottle interface and on the sample label. Place and secure sample within cooler and complete all sample collection documentation.

5.3. VOC Sample Collection Procedure

- 5.3.1. Without methanol preservation:



5.3.1.1. In addition to procedures outlined in Section 5.2, completely fill a clean, dry appropriately sized soil. Do not agitate the sample container or tap the bottom of the jar on a surface to pack. Minimize large void spaces by carefully packing the soil into the jar using the disposable spatula .

5.3.2. With methanol preservation:

5.3.2.1. Tare a clean, dry sampling vial. Record the tare weight.

5.3.2.2. Use a 1:1 ratio between the volume of methanol and mass of soil (ex. 5 grams soil to 5 mL methanol, 15 grams soil to 15 mL methanol, etc.). The total volume will be determined to sufficiently meet the requirements for laboratory analysis.

5.3.2.3. Add the predetermined volume of methanol to the sampling container. Record the volume of methanol added.

5.3.2.4. Add the pre-measured soil plug from the disposable sampling device into the sample vial containing methanol.

5.3.2.4.1. The modified syringe will have the tip cut off to allow for soil collection. The rubber seal on the plunger will be removed to allow air to escape the syringe during sampling and the plastic knob used to hold the rubber seal will be cut off to create a flat surface that soil can be expelled completely from the syringe.

5.3.2.5. Invert the soil / methanol mixture several times to mix.

5.3.2.6. Record the total weight of the vial, methanol and soil. Determine the actual mass of the soil in the vial and record.

5.3.2.7. Provide the original methanol volume and final soil mass data to laboratory.

5.4. PCB Composite Sample Collection Procedure

5.4.1. Determine the locations of aliquots to be collected and composited for each sample as described in section 4.2 of the *Willow Brook Willow Pond Remedial Action Work Plan*.



- 5.4.2. With a disposable spatula, scrape approximately 4 inches of soil off of the surface of the sample collection point to obtain a previously unexposed sample surface.
- 5.4.3. Using a 10cc modified disposable plastic syringe, collect each aliquot. Aliquots will be collected on a volumetric basis such that each aliquot will consist of an equal volume of soil. The total volume will be enough to sufficiently meet the requirements for laboratory analysis.
 - 5.4.3.1. The modified syringe will have the tip cut off to allow for soil collection. The rubber seal on the plunger will be removed to allow air to escape the syringe during sampling and the plastic knob used to hold the rubber seal will be cut off to create a flat surface that soil can be expelled completely from the syringe.
- 5.4.4. Inspect the sample site and the contents of the transparent syringe to assess the potential presence of free liquid. If free liquid or the likelihood of free liquid is observed, place the syringe into a beaker and allow to “rest” an adequate timeframe to allow separation of the liquid. Decant any free liquid and assess the volume of material remaining in the syringe. Add material as necessary to achieve the volume required to match the other aliquots and repeat this step if necessary.
- 5.4.5. Completely empty each equivalent aliquot of soil from the disposable syringe into an appropriate sampling container.
- 5.4.6. As each aliquot is placed into the container, use a disposable wooden spatula to completely and thoroughly mix the aliquots. Repeat the mixing process after the addition of each aliquot.
- 5.4.7. At each location where an aliquot is collected, collect an additional syringe of soil and place it into a separate sampling container provided for measurement of moisture content

5.5. Post Sampling Procedures

- 5.5.1. As required, upon completion of all sampling procedures for a particular site, secure the lid of the cooler using packaging tape with the chain of custody inside.



- 5.5.2. Should the laboratory be local, transport the samples directly to the laboratory and present them to the sample manager. The representative of LEA should witness the verification of the chain of custody and obtain a carbon copy for filing in the project notebook.
- 5.5.3. Should the laboratory be distant, arrange for transport with a reputable carrier service. The cooler and samples shall be secured for transport, and all mailing documentation secured onto the top of the cooler. Unless otherwise specified, delivery shall be overnight. A request for confirmation of acceptance should be made to the carrier at the time of pick-up.

5.6. Documentation

- 5.6.1. The following general information shall be recorded in the field log book and/or on the appropriate field forms:

- project and site identification
- LEA commission number
- field personnel
- name of recorder
- identification of borings
- collection method
- date and time of collection.
- types of sample containers used, sample identification numbers and QA/QC sample identification
- preservative(s) used
- parameters requested for analysis
- field analysis method(s)
- field observations on sampling event
- name of collector
- climatic conditions, including air temperature
- internal temperature of field and shipping (cooled) containers
- chronological events of the day
- status of total production
- record of non productive time
- QA/QC data

- 5.6.2. The following information shall be recorded on the Daily Field Report QA Checklist:

- reviewer's name, date, and LEA commission number



- review of all necessary site activities and field forms
- statement of corrective actions for deficiencies

5.6.3. The following information shall be recorded on the chain of custody record:

- client's name and location
- date of sample collection
- sample number
- container type, number, size
- preservative used
- signature of collector
- signatures of persons involved in the chain of possession
- analyses to be performed
- type and number of samples

5.6.4. The following information shall be provided on the sample label using an indelible pen:

- sample identification number
- date and time of collection
- place of collection
- parameter(s) requested (if space permits)

5.6.5. The following information shall be recorded on the general sample collection data sheet:

- client name, location and LEA commission number
- boring or sampling location identification number
- date and time of collection
- sample number
- depth sample was obtained
- field instrumentation reading

5.6.5.1. Composite sample collection data sheet: In addition to the general field sample collection data sheet, a site specific sampling grid will be used to record sampling locations for PCB composite samples. The samples will be designated using a sample class code of "SSC" which indicates that the sample is a "soil sample area composite." A single sample number will be given to the final composite sample. However, the individual aliquots will be identified using a



suffix (-a, -b, -c, -d, etc.) and identified on the field sampling grid sheet. The location of the composite will be identified using the grid coordinates which represent the specific 1600 square foot sampling area from which it was collected.

6. Records

- 6.1. Additional records may be identified within documents referenced by this procedure.

7. References

- 7.1. ASTM Standard D 420
- 7.2. EPA document Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)

8. Nature of Change for this Issue

- 8.1. Original issue to establish SOP requirements.

END OF DOCUMENT



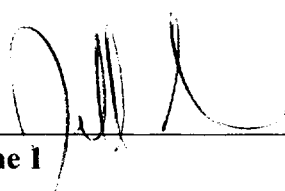
**Standard Operating Procedure
for
Hand Auger Borings**

SOP ID: 10003

Date Initiated: 2/20/90

Revision #005: 6/13/97

Approved By:



Name 1 **Date** 6-13-97



Name 2 **Date** 6/13/97

LOUREIRO ENGINEERING ASSOCIATES

Standard Operating Procedure For Hand Auger Borings

1. Statement of Purpose

This section discusses procedures for conducting hand auger soil borings either for exploration or for the installation of monitoring wells. The procedures provided in this text outline the advancement, decontamination, abandonment, and required documentation for the completion of hand auger borings. This document was prepared in accordance with ASTM D 1452 - 80. Soil sampling for chemical analysis is covered under "STANDARD OPERATING PROCEDURES FOR SOIL SAMPLING."

2. Equipment and Decontamination

2.1. Equipment required for conducting hand auger boring shall include:

- Hand auger (bucket or dutch)
- Auger extensions, wrenches, and handle
- Hand towels
- Portable VOC analyzer (Photovac Microtip® or equivalent)
- Polyethylene plastic sheeting
- Distilled water
- Field documentation
- Indelible marker
- Three 5-gallon buckets
- Alconox detergent, methanol, hexane, nitric acid
- Graduated cylinder
- Analytical balance (accurate to 0.1 gram)
- 500 ml disposable beakers
- Decontamination brushes
- Personal protective equipment
- Clipboard
- Pry bar

operations on a site. The locations of all proposed borings must be clearly marked in the field prior to notification. The site manager MUST call and confirm that each utility has been to the site and has marked their respective lines.

2.2.2 Particularly upon larger private sites, consult with the Owner or other person knowledgeable about the site as to locations of potential private or abandoned utilities and locate these prior to beginning work. Upon the discretion of the Project Engineer/Manager, a pipe locator can also be used to assist in locating utilities.

2.2.3 Note that OSHA may have additional requirements for location of utilities.

2.2.4 All efforts to locate underground utilities should be properly documented in the field log book prior to onset of the work scheduled.

2.3 OSHA

The Senior LEA representative shall be the Competent Person required by OSHA for all work. However, this does not relieve other LEA representatives from bringing to his or her attention conditions which may be unsafe or present a hazard to the drilling crew, the general public, or other workers on the site.

2.4 Decontamination

2.4.1 All down-hole and sampling equipment will be sufficiently decontaminated prior to use. Decontamination procedures presented in site specific work plans may vary slightly from those presented below, dependent upon the particular types of contaminants encountered.

2.4.2 A section of 5-mil plastic sheeting shall be cut of sufficient size to underlie the decontamination area to contain any discharge of decontamination solutions.

2.4.3 The following solutions (as appropriate for the anticipated contaminants) shall be prepared and placed in 500-ml laboratory squirt bottles: methanol solution (less than 10% solution); 10% nitric acid solution; 100% hexane solution; and distilled deionized (DI) water. A fifth solution of phosphate-free detergent and tap water (approximately 2.5 gallons) shall be prepared in a five-gallon bucket.

2.4.4 All loose debris shall be removed from the augers and spatulas into an empty 5-gallon bucket or plastic sheeting, using a stiff bristled brush.

2.4.5 The order of decontamination solutions is as follows:

- 1) Detergent Scrub
- 2) DI Water Rinse
- 3) Hexane Rinse (to be used only if separate-phase petroleum product, other than gasoline, is present)
- 4) DI Water Rinse
- 5) 10% Nitric Acid Rinse (to be used only when metals are suspected as potential contaminants)
- 6) DI Water Rinse
- 7) Methanol Rinse (<10% solution)
- 8) Air Dry

2.4.6 Wrap each piece of decontaminated equipment in aluminum foil to maintain cleanliness.

2.4.7 At the end of the project day, all used equipment shall be decontaminated. Dispose of all spent decontamination solutions in accordance with all applicable municipal, state and federal regulations.

2.5 Water

2.5.1 Water is occasionally required to maintain the stability of the boring. If water is used, the source(s), quality, and volume(s) will be recorded on the boring log.

2.5.2 No other drilling fluid, may be used without specific authorization from the Project Manager.

2.6 VOC Monitoring

2.6.1 A portable volatile organic compound (VOC) analyzer shall be available on site and shall be used to screen all cuttings and fluids (if any) removed from the hole.

2.6.2 Since, in general, it cannot be presumed that a site is clean, all cuttings and/or fluids which show a reading on the VOC analyzer above background shall be containerized or drummed, as appropriate, on the site.

Section 3.6 provides additional information on management of potentially contaminated fluids and materials.

- 2.6.3 All health and safety requirements shall be addressed in the Site-Specific Health and Safety Plan for each site.

3.0 Procedure

3.1 Site Preparation

- 3.1.1 A sufficient area shall be cordoned off to restrict access to the work area. This area shall be termed an "Exclusion Zone".
- 3.1.2 An equipment decontamination area shall be assembled, as described in Section 2.4, within the exclusion zone.
- 3.1.3 The area immediately surrounding the proposed borehole shall be covered with 5-mil plastic sheeting (minimum area: 10 square feet). A hole of sufficient diameter shall be cut from the center of the plastic sheeting to facilitate auger advancement.
- 3.1.4 All personal protective equipment shall be donned.
- 3.1.5 Should flooring need to be breached for the advancement of the boring, coring of the floor will be conducted using a concrete coring saw and a wet-dry vacuum to prevent water and cuttings from moving beyond the immediate vicinity of the borehole.

3.2 Auger Advancement

- 3.2.1 Begin the boring by rotating and advancing the auger to the desired depth. Remove the auger and examine the soil for texture, composition, density, moisture and grain-size distribution. Record all information as described in Section 3.4.
- 3.2.2 The soils removed shall be logged in two-foot increments or at each lithologic change.
- 3.2.3 Collect a sufficient aliquot of the soil sample to satisfy all requirements for field and laboratory analysis. A lithologic sample may be required and should be obtained into a 4-ounce soil jar. The procedures for collection

of soil samples for chemical analysis are described in the *Standard Operating Procedures for Soil Sampling*.

- 3.2.4 Discard boring spoils into the appropriate containers or onto the plastic sheeting for later disposal.

3.3 Field Analysis

- 3.3.1 The probe used to detect VOCs shall be either a Photovac Microtip® photoionization detector or a Foxboro OVA® flame ionization detector or equivalent and calibrated in accordance with the instructions provided in Attachment A to this SOP. Calibration shall be performed, at a minimum, prior to each sampling event and checked after each day of sampling.

- 3.3.2 The following procedure shall be used to obtain readings of the VOCs present in a soil sample:

- 1) Obtain an aliquot of soil (approximately 50 grams) from the bottom of the auger and place it into a Ziploc® plastic bag or equivalent and seal.
- 2) Agitate the sample, assuring that all soil aggregates are broken, for two minutes.
- 3) Carefully break the seal of the bag enough to insert the VOC probe.
- 4) Record the maximum reading obtained on the appropriate forms, as described in Section 3.4.

3.4 Field Documentation

- 3.4.1 The following general information shall be recorded in the field log book and/or the appropriate field form(s).

- Project and site identification
- LEA commission number
- Field personnel
- Name of recorder
- Identification of borings
- Collection method
- Date and time of collection

- Types of sample containers used, sample identification numbers and QA/QC sample identification
- Field analysis method(s)
- Field observations of sampling event
- Name of collector
- Climatic conditions, including air temperature
- Chronological events of the day
- Status of total production
- Record of non-productive time
- QA/QC data
- Location of boring(s) on site in sufficient detail to relocate boring at a future time (include sketch)

3.4.2 The following information shall be recorded on the boring log:

- Project name, location, and LEA commission number
- Borehole number, borehole diameter, boring location, drilling method, field crew performing work, groundwater observations, logger's name and date
- Depth below grade, sample I.D. number, duplicate numbers, VOC analyzer reading
- A complete sample description, including as a minimum: depth, material size gradation using the Burmeister system, color, moisture, and density
- Should a well be constructed in a bore hole, a complete well schematic shall be drawn and accurately labeled
- Use of water, including source(s) and quantity

3.4.3 The following information shall be recorded on the Field Quality Review Checklist:

- Reviewer's name, date, and LEA commission number
- Review of all necessary site activities and field forms
- Statement of corrective actions for deficiencies

3.4.4 The Field Instrument & Quality Assurance Record shall include the following information:

- Client's name, location, LEA commission number, date
- Instrument make, model, and type
- Calibration readings
- Calibration/filtration lot numbers
- Field personnel and signature

3.5 Disposal of Potentially Contaminated Materials

- 3.5.1 Potentially contaminated cuttings or fluids, as indicated by knowledge of the site, discoloration, VOC analyzer readings, or other evidence, shall be containerized on the site pending sampling and determination of hazardous waste status.

3.6 Boring Abandonment

- 3.6.1 If the boring is not to be used for other purposes (i.e. monitoring well, soil vapor probe, soil vapor extraction well, etc.), it shall be abandoned.
- 3.6.2 The boring shall be filled and sealed with neat cement grout, or high-density bentonite clay grout.
- 3.6.3 Excess cuttings shall be containerized and sampled before disposal.
- 3.6.4 In paved areas, the upper three feet of the borehole shall be filled, up to two inches below the existing grade, with sand to allow for repairing of the pavement.
- 3.6.5 Pavement shall be repaired using cold patch asphalt filler or concrete.

4.0 Other

Depending on the specific site, other considerations may be applicable. Consult the OSHA regulations, applicable RCRA or CERCLA regulations, and the site-specific work plan for details.

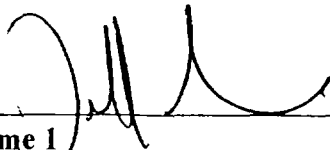
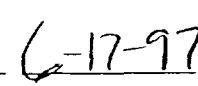
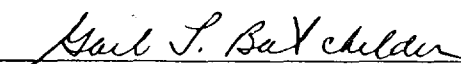
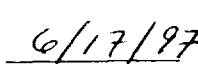
**Standard Operating Procedure
for
Liquid Sample Collection and Field Analysis**

SOP ID: 10004

Date Initiated: 2/20/90

Revision #004 : 06/12/97

Approved By:

	
Name 1	Date
	
Name 2	Date

LOUREIRO ENGINEERING ASSOCIATES

Standard Operating Procedure For Liquid Sample Collection and Field Analysis

1.0 Statement of Purpose

This document describes procedures to be followed for measurement of static water level elevations, detection of immiscible layers, well evacuation, sample withdrawal, and field analyses.

2.0 Equipment and Decontamination

2.1 Equipment required for the collection and field analysis of liquid samples shall include:

- water-level indicator (accurate to 0.01 foot)
- distilled water
- hand towels
- portable VOC analyzer (Photovac Microtip®, Foxboro OVA® or equivalent)
- interface probe, clear PVC or fluorocarbon resin bailer
- pH and temperature meter (capable of accuracy to 0.1 pH unit)
- specific conductance meter
- two-inch diameter, fluorocarbon resin or stainless steel bailers (clean) with disposable nylon or polyethylene rope
- polyethylene plastic sheeting
- centrifugal pump with fluorocarbon resin foot valve, peristaltic pump and polyethylene tubing, or other appropriate pumping apparatus
- clean disposable gloves
- Alconox®, or other non-phosphate laboratory grade detergent
- Three 5-gallon buckets
- Decontamination brushes
- Distilled, de-ionized water
- Decontamination fluids (< 10% methanol in water, 100% n-hexane, and 10% nitric acid)

2.2 Equipment Decontamination

All materials and equipment which enter a well must be clean and free of any potential contaminants. In general, the choice of decontamination procedures

should be based upon a knowledge of the site-specific contaminants and outlined in the site-specific work plan.

For sites at which the contaminants are unknown, but contamination is suspected, the decontamination procedures outlined below should be followed.

- 2.2.1 Prior to commencing any field activities, the following solutions (as appropriate for the appropriate contaminants) should be prepared and placed into 500-ml laboratory squirt bottles: 10% methanol in water; 10% nitric acid in water; 100% n-hexane; distilled, de-ionized water.
- 2.2.2 In the field, prepare approximately 2.5 gallons of a solution of Alconox® (or other suitable non-phosphate laboratory grade detergent) in tap water in a 5-gallon bucket.
- 2.2.3 Prepare a piece of 5-mil polyethylene sheeting to underlie the decontamination area. The sheeting should be of sufficient size to contain any accidental discharge of decontamination solutions. The plastic should be bermed to contain spills.
- 2.2.4 The order for decontaminating equipment is as follows:
 - 1) Detergent scrub
 - 2) DI water rinse
 - 3) Hexane rinse (to be used only if separate-phase petroleum product, other than gasoline, is present)
 - 4) DI water rinse
 - 5) 10% nitric acid rinse (to be used only when metals are suspected as potential contaminants)
 - 6) DI water rinse
 - 7) Methanol rinse (<10% solution)
 - 8) Air dry
- 2.2.5 Materials such as the cord should not be decontaminated and should just be disposed of after each test.
- 2.2.6 Wrap each piece of decontaminated equipment in aluminum foil, as appropriate, to maintain cleanliness.
- 2.2.7 At the end of the project day, dispose of all spent decontamination fluids and materials such as the polyethylene sheeting and personal protective

equipment in accordance with all applicable municipal, state, and federal regulations.

3.0 Sample Collection

3.1 Measurement of Static Water Level

- 3.1.1 The static water elevations in each well shall be measured prior to each sampling event. This is performed initially to characterize the site, and in subsequent sampling rounds to determine whether horizontal or vertical flow gradients have changed. A change in hydrologic conditions may necessitate modification of the groundwater monitoring program.
- 3.1.2 Remove the protective cover and locking cap.
- 3.1.3 The air in the well head will be sampled for volatile organic compounds (VOCs) using a portable VOC analyzer, such as a Photovac Microtip®. The instrument shall be zeroed with ambient air prior to the measurement, and the initial and final readings shall be recorded for each well.
- 3.1.4 Each well shall have a surveyed reference point located at the top of the well casing with the locking cap removed. The reference point shall be easily recognizable, since the personnel conducting the sampling may differ from one sampling event to the next.
- 3.1.5 The following parameters shall be measured with an accuracy of 0.01 ft:
 - depth to standing water
 - depth to bottom of well
- 3.1.6 A water-level indicator with a fiberglass tape will be used for measurement. Due to possible pressure differences between the well atmosphere and the ambient atmosphere, the water level will be allowed fifteen minutes to equilibrate upon removal of the well cap. The results shall be recorded on the appropriate field form(s).
- 3.1.7 Total depth measurements will be compared to original depths to determine the degree of siltation that may have occurred. This information shall be noted on the field form. Should significant siltation occur in any well, the well shall be redeveloped by an approved method.

- 3.1.8 The portion of the tape immersed in the well shall be decontaminated during retrieval using a distilled water rinse followed by drying with a clean wipe, prior to use in another well. This decontamination procedure shall be amended, as needed, to accommodate the specific type of contamination anticipated.

3.2 Detection of Immiscible Layers

- 3.2.1 Should evidence warrant, a sampling event shall include provisions for detection of immiscible phases prior to well evacuation or sample collection. Light non-aqueous phase liquids (LNAPLs) are relatively insoluble liquid organic compounds with densities less than that of water (1 g/ml), while dense non-aqueous phase liquids (DNAPLs) are organic compounds with densities greater than that of water. Lighter and/or denser immiscible phases may be encountered in a groundwater monitoring well.
- 3.2.2 An interface probe will be used to determine the existence of any immiscible layers, light or dense. Alternatively, a clear fluorocarbon resin or PVC bailer may be used to determine the existence of the phases or oil sheen in the well when no accurate determination of the immiscible layer thickness is required.
- 3.2.3 Should elevations of the immiscible layers be required, levels of the fluids shall be measured to an accuracy of 0.02 feet using an electronic interface probe capable of detecting the interfaces between air, product, and water. The interface levels shall be recorded in the field notebook. Adjustments of the observed head to the theoretical hydraulic head shall be calculated based on the density conversion factor associated with the particular non-aqueous phase liquid.
- 3.2.4 The immiscible layers and groundwater shall then be purged into 55-gallon 17H DOT drum which shall be labeled and characterized for disposal.

3.3 Field Analysis

- 3.3.1 Parameters that are physically or chemically unstable shall be tested immediately after collection using a field test kit or other equipment. Such parameters as pH, temperature, and specific conductance will be measured in the field, at the temperature of the well sample.
- 3.3.2 A standard pH meter with a glass or polymer-body electrode (Orion pH Meter model SA 250 or equivalent) shall be used. The meter shall be

calibrated prior to use using two buffer solutions, in accordance with the instructions included in Attachment A to this SOP. Calibration shall be checked using the two buffer solutions prior to sampling each well. Calibration information to be recorded in the field log will be the temperature and pH readings in each buffer before and after each calibration. The date the buffer was prepared shall also be noted in the field notebook.

The temperature and pH probes shall be placed into a sample and allowed to stabilize for a minimum of twenty seconds. The accuracy of measurement shall be 0.1 pH units and 0.1° Celsius. The sample shall be discarded in an appropriate manner upon completion of analysis.

- 3.3.3 Specific conductance will be measured using Cole-Parmer Conductivity Meter model 1481-55 or equivalent that has been calibrated in accordance with the instructions provided in Attachment A to this SOP. Calibration shall be performed prior to each sampling event and checked after each day of sampling.

The specific conductance probe shall be added to the sample container following measurement of the pH and temperature. The conductance meter will be adjusted for the temperature of the sample. Twenty seconds shall be allowed for stabilization prior to obtaining a reading. Accuracy shall be as stipulated by the range of the instrument.

- 3.3.4 These probes shall be decontaminated using a distilled/deionized water rinse between each sample. To the extent possible, the same probe and meter shall be used for all measurements at a given site for the duration of monitoring at the site.

3.4 Well Evacuation

- 3.4.1 Calculate standing water in the well based on the following schedule and record on the appropriate field form:

Well Diameter (inches)	Conversion Factor (gal/feet)
2	0.163
4	0.654
6	1.47

- 3.4.2 Generally, a centrifugal, submersible, air-lift, bladder, inertial, or peristaltic pump equipped with a fluorocarbon resin or PVC foot valve on the end of dedicated tubing, as appropriate, may be used to evacuate the monitoring wells. Alternatively, evacuation of the wells may be accomplished using a bailer.
- 3.4.3 A new piece of polyethylene plastic shall be placed on the ground adjacent to the well. Sampling and purging equipment, such as pump, tubing, bailers and bailer twine, containers, etc., shall be placed on the polyethylene sheet, never on the ground.
- 3.4.4 Don disposable gloves, prepare pump and tubing for insertion into the well, ensuring that any tubing or pump apparatus is of sufficient length to reach the appropriate depth for pumping.
- 3.4.5 Lower the pump and/or tubing gently into the water column and begin pumping.
- 3.4.6 Measure pH, temperature and specific conductance in the well from the first water extracted during the purging process.
- 3.4.7 Remove a volume of water equal to 3 to 5 times the standing water from the well measured in a 5-gallon bucket.
- 3.4.8 If it is not possible to remove three volumes as described above, due to slow recovery of the well, the well shall be emptied and allowed to recover. Samples obtained from slow-yielding wells shall be extracted as soon as a sufficient volume is available for a sample for each parameter.
- 3.4.9 Measure pH, temperature, specific conductance prior to sampling.
- 3.4.10 Well evacuation is deemed to be complete when the following criteria have been met:
- pH measurements vary no more than ± 0.5 standard units
 - specific conductance measurements vary no more than $\pm 10\%$
 - temperature measurements vary no more than $\pm 1^{\circ}\text{C}$
 - turbidity measurements (if used) are below 5 NTU, if practicable
- or a maximum of five well volumes have been removed from the well

- 3.4.11 Measure pH, temperature, specific conductance again after sampling to determine effectiveness of purging and sample stability.
 - 3.4.12 Do not re-use purging equipment (bailers, rope, tubing, sampling vials, etc.). Any non-disposable bailers shall be returned to the office for decontamination. Pumps shall be decontaminated between monitoring wells, in accordance with procedures noted in Section 2.2
 - 3.4.13 Bailer twine and other consumables, such as filter apparatus, shall be disposed of appropriately.
 - 3.4.14 Record sampler's name, sampling time, volume of water purged, parameters measured, weather conditions, sample number, analyses required and all other pertinent information in field notebook and/or appropriate field forms, and complete the chain of custody form.
 - 3.4.15 Any water purged from the monitoring wells shall be stored in appropriate containers until the laboratory analyses are available. Then it should be disposed of in accordance with all applicable local, state and federal requirements.
 - 3.4.16 Storage shall be in containers approved for storage of hazardous materials, and in an appropriate designated location at the facility.
- 3.5 Sample Withdrawal
- 3.5.1 In order to ensure that the groundwater sample is representative of the formation, it is important to minimize physical alteration (i.e. agitation during purging and/or sample collection) or chemical contamination of the sample during the withdrawal process. The sample set shall include enough dedicated bailers to obtain samples from each well, plus 10%.
 - 3.5.2 Use either an appropriate pump or fluorocarbon resin or stainless steel bailer to purge each well (the same pump used for purging may be used for sample withdrawal, with the exception that samples intended for VOC analysis must be collected using either a bailer or a bladder pump.). Do not reuse a bailer in the field; used bailers shall be returned to the office for decontamination.

3.5.3 To minimize agitation of the water column, samples shall be collected from the pump tubing in the following order into pre-labeled sample containers:

- Extractable organics (semi-volatile)
- Total petroleum hydrocarbons
- PCBs
- Metals
- Phenols
- Cyanide
- Chloride and sulfate
- Nitrate and ammonia
- Turbidity
- Radionuclides

Samples to be analyzed for the following constituents shall be collected using a bailer, after any pump and tubing have been removed from the well. Removal of any downhole equipment should be done carefully and in a manner that minimizes disturbance of the water column.

- Volatile organic compounds (VOCs)
- Purgeable organic carbon (POCs)
- Purgeable organic halogens (POX)
- Total organic halogens (TOX)
- Total organic carbon (TOC)

3.5.4 Samples shall be obtained from the monitoring wells as soon as possible after purging. This may require waiting an extended period for low-yielding wells.

3.5.5 Samples collected for VOC analysis shall be free of any air bubbles and inverted upon filling. Bacterial samples shall be collected using dedicated gloves; taking care not to allow anything to touch the inside of the sampling container.

3.5.6 Samples collected for dissolved metals analysis, which are to be filtered in the field, shall be passed through a 0.45 micron (maximum) filter (either in-line or under negative pressure) prior to placement in the sample bottle.

3.5.7 In situations where replicate samples shall be required, care shall be taken to ensure that each sample collected is independent.

3.5.8 In some situations, inorganic parameters may be sampled directly from a pump after completion of well evacuation procedures.

3.6 Field Documentation

3.6.1 Field documentation shall include at a minimum: a chain-of-custody form, Field Data Record Groundwater Form, Sample Collection Form, Daily Field Report, Field Quality Review Checklist. Sample labels and sample seals shall be used for proper sample identification.

3.6.1.1 The labels shall be sufficiently durable to withstand immersion for 48 hours without detaching and to withstand normal handling. The information provided shall be legible at all times.

3.6.1.2 The following information shall be provided on the sample label using an indelible pen:

- Sample identification number
- Date and time of collection
- Place of collection
- Parameter(s) requested (if space permits)

3.6.1.3 A field logbook and/or appropriate field forms will be used to log all pertinent information with an indelible pen. The following information shall be provided:

- Identification of well
- Static water level measurement technique
- Presence of immiscible layers and detection method
- Time well purged
- Collection method for immiscible layers and sample identification numbers
- Well evacuation procedure/equipment
- Sample withdrawal procedure/equipment
- Date and time of collection
- Types of sample containers used and sample identification numbers
- Preservative(s) used
- Parameters requested for analysis

- Field analysis method(s)
- Whether or not field filtration was performed and the filter size, if appropriate
- Field observations on day of sampling event
- Record of site activities
- Name of collector
- Climatic conditions, including air temperature
- Status of total production

3.6.1.4 The Field Sampling Record shall include at a minimum the following information:

- Identification of well
- Date and time of collection
- Name of collector
- Sample number

3.6.1.5 The chain-of-custody record shall include the following information:

- Company's name and location
- Date and time of collection
- Sample number
- Container type, number, size
- Preservative used
- Signature of collector
- Signatures of persons involved in the chain of possession
- Analyses to be performed
- Project and site location
- Inspectors and time of inspection
- Record of non-productive time
- Type and number of samples, total number of sample bottles, and sampling method

3.6.1.6 The Field Data Record Groundwater Form shall be updated during the sampling of each well and include the following information:

- Identification of well
- Well depth, diameter, depth to water

- Static water level depth and measurement technique
- Purge volume and pumping rate
- Time well purged
- LEA commission number
- Date

3.6.1.7 The Field Quality Review Checklist shall assure the completeness of the sampling round and include the following information:

- Reviewer's name, date, and LEA commission number
- Review of all necessary site activities and field forms
- Statement of corrective actions for deficiencies

ATTACHMENT A
Calibration Procedures

pH MEASUREMENTS

MEASUREMENT PROCEDURES

pH Measurements

See **Figure 6**.

A calibration with one or two buffers should be performed before pH is measured. It is recommended that a calibration with two buffers be performed at the beginning of each day to determine the correct slope of the electrode. This serves the dual purpose of determining if the electrode is working properly and storing the slope value in the meter's memory. Perform a one buffer calibration every two hours to compensate for electrode drift.

Check the stored value for **ISO** before calibration. Unless the isopotential point of the electrode is known verify that the display reads **7.00**. If not, scroll until **7.00** is displayed and press **enter**. See **Isopotential Point**.

There are two ways of calibrating the SA 250 Meter, autocalibration or manual calibration.

NOTE: It is recommended to select either autocalibration or manual calibration and not use a combination of the two methods. Following is a description and instructions for each method.

Autocalibration

Autocalibration is a feature of the SA 250 Meter that automatically recognizes the 7.00, 4.01 and 10.01 buffers with a range of ± 0.5 pH units. The user waits until the pH display is stable and presses **enter**. The SA 250 Meter automatically calibrates to the correct buffer value using temperature compensation. Do not scroll when using autocalibration.

While calibrating, the SA 250 Meter compares actual values to theoretical values to determine if the buffer is within range. Buffers greater than ± 0.5 pH units from the correct value will trigger an operator assistance code.

It is recommended that an ATC probe be used for autocalibration. If an ATC probe is not used, all samples and buffers should be at the same temperature or use manual temperature compensation. See **Temperature Mode**.

Autocalibration With Two Buffers

1. Connect electrode(s) to meter. Slide the **mode** switch to either **pH .1** or **pH .01**. Choose either 4.01 and 7.00, or 7.00 and 10.01 buffers, whichever will bracket your expected sample range.
2. Place electrode(s) into either 4.01, 7.00 or 10.01 buffer.
3. Press **cal**. The display will alternate between **.1** and the pH value of the buffer, indicating this is the first buffer and a value has not been entered. Wait for a stable pH display and press **enter**. The correct display will freeze for 3 seconds then advance to **.2**, indicating the meter is ready for the second buffer

4. Rinse electrode(s) and place into a second buffer. Wait for a stable pH display and press **enter**.

After the second buffer value has been entered the letters **PH** will be displayed. The meter is now calibrated and automatically advances to **sample** mode.

5. Rinse electrode(s), place into sample. Record pH directly from the meter's display.

Autocalibration With One Buffer

1. Check slope term by pressing **slope**. If necessary, scroll and enter the correct value. If slope value is unknown, either enter 100.0 or perform a two buffer calibration. A single buffer calibration does not change the slope term.
2. Connect electrode(s) to meter. Slide **mode** switch to either **pH .1** or **pH .01**.
3. Place electrodes into either 4.01, 7.00 or 10.01 buffer:
4. Press **cal**. The display will alternate between **.1** and the pH value of the buffer, indicating this is the first buffer and a value has not been entered.
5. Wait for a stable pH reading and press **enter**.

After **enter** is pressed the correct display will freeze for 3 seconds then advance to **.2**, indicating the meter is ready for the second buffer. By pressing **sample** the letters **PH** will be displayed, indicating the meter has advanced into the sample mode.

6. Rinse electrode(s) and place into sample. Read the pH directly from the display.

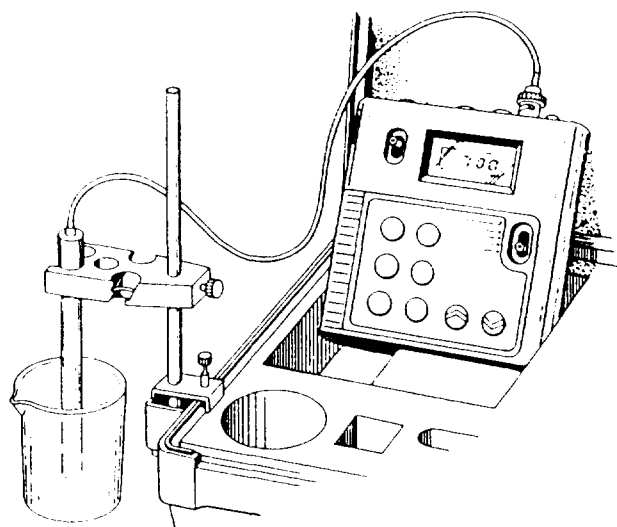


Figure 6
Optional Way to Set Up SA 250 Meter
for Sample Measurements

Manual Calibration

To calibrate with buffers other than 4.01, 7.00 or 10.01, use the manual calibration technique. The calibration sequence is the same as autocalibration, except buffer values are scrolled in.

It is recommended that an ATC probe be used. If an ATC probe is not used, all samples and buffers should be the same temperature or use manual temperature compensation. See **Temperature Mode**.

NOTE: Even if scrolling is not necessary, scroll one digit and return to correct value before pressing enter. Otherwise meter will assume autocalibration is to be used.

Manual Calibration With Two Buffers

1. Connect electrode(s) to meter. Slide **mode** switch to either **pH .1** or **pH .01**. Choose two buffers that will bracket your expected sample range.
2. Place electrode(s) into the first buffer.
3. Press **cal**. The display will alternate between **.1** and the pH value of the buffer, indicating this is the first buffer and a value has not been entered.
4. Wait for a stable pH display. Using **^**, **v** or **X10** keys, scroll in the correct value and press **enter**.

The display will freeze for 3 seconds then advance to **.2**, indicating the meter is ready for the second buffer.

5. Rinse electrode(s) and place into the second buffer. Wait for a stable pH display. Scroll in the correct value and press **enter**.

After the second buffer value has been entered the letters **PH** will be displayed. The meter is now calibrated and automatically advances to the **sample** mode.

6. Rinse electrode(s) and place into sample. Record pH directly from the meter's display.

Manual Calibration With One Buffer

1. Verify slope by pressing **slope**. If necessary scroll in correct value, using **^**, **v** and **X10** keys, and press **enter**. If correct slope is unknown, either enter **100.0** or perform a two buffer calibration.

2. Connect electrode(s) to meter. Slide **mode** switch to either **pH .1** or **pH .01**.

3. Place electrodes into the buffer.

4. Press **cal**. The display will alternate between **.1** and the pH value of the standard, indicating this is the first buffer and a value has not been entered.

Wait for a stable pH display, scroll until the correct value is displayed and press **enter**.

The display will freeze for 3 seconds then advance to **.2**, indicating the meter is ready for the second buffer. By pressing **sample** the letters **PH** will be displayed. The meter is now calibrated and automatically advances to **sample** mode.

5. Rinse electrode(s) and place into sample. Read the pH directly from the display.

NOTE FOR MANUAL CALIBRATION: In the event that scrolling was started but the value was not entered and the mode switch was changed, either a P1 or a P2 will be displayed upon returning to the pH mode. P1 indicates that a value has not been entered for the first buffer while P2 indicates a value has not been entered for the second buffer.

Slope

By pressing the **slope** key the slope is displayed as a percent of theoretical. A properly functioning electrode will have a 92% to 102% slope. See **Troubleshooting**, if the slope is out of range. The slope value is retained in the meter's memory until another two buffer calibration is performed or another value is entered. A one buffer calibration does not change the slope value.

At the beginning of each day and every time a different electrode is used a two buffer calibration should be performed for accurate measurements.

To enter a slope value:

1. Slide the **mode** switch to either **pH .1** or **pH .01**.
2. Press the **slope** key.
3. Scroll, using **^**, **v** or **X10** keys, until the correct value is displayed.
4. Press **enter**.

ORION SA 250 pH METER

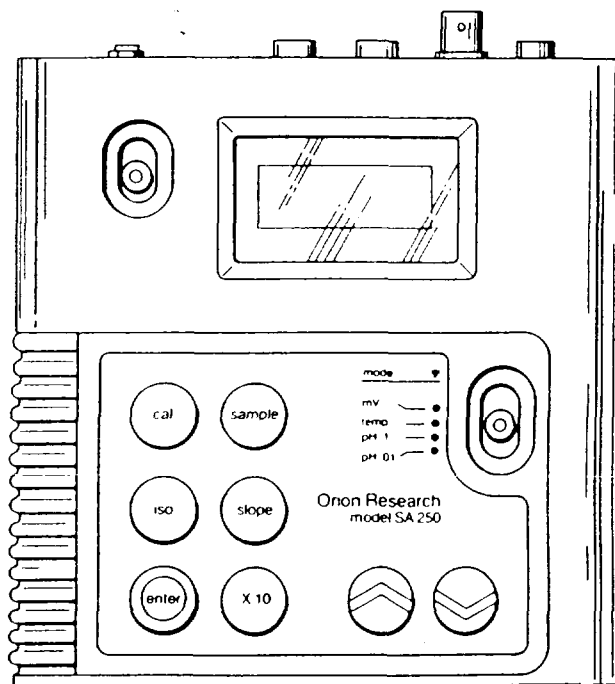
Autocalibration With Two Buffers and an ATC Probe

Select either 4.01 and 7.00, or 7.00 and 10.01 buffers, whichever will bracket the expected sample range.

An ATC probe is used for convenience and accuracy. Once the ATC probe is plugged into the input jacks, and placed into solution, entering temperature values manually is not possible. The ATC probe automatically senses buffer or sample temperature for use in calculating accurate pH values.

1. Connect electrodes and ATC probe to meter.
2. Select pH mode and resolution by sliding the **mode** switch to **pH .1** or **pH .01**.
3. Press **iso** and verify that the isopotential point is 7.00.
4. Place electrodes and ATC probe into 7.00 buffer.
5. Press **cal**. The display will alternate between **.1** and the pH value of the buffer, indicating that the electrodes are in the first buffer and a value has not yet been entered.
6. Wait for the pH value to stabilize. Press **enter**. The correct display will freeze for 3 seconds, then advance to **.2**, indicating the meter is ready for the second buffer.
7. Rinse electrodes and ATC probe and place into the second buffer, either 4.01 or 10.01. The display will alternate between **.2** and the pH value of the buffer.
8. Wait for the pH value to stabilize. Press **enter**. The letters **pH** will be displayed. The SA 250 Meter is now calibrated and automatically advances into the sample mode.
9. Rinse electrodes and ATC probe and place into sample. Read the pH directly from the display.

NOTE: A different isopotential point can be entered. However, if you do not know the isopotential point of your pH electrode, the 7.00 default setting is recommended for Ag/AgCl and ROSS pH Electrodes.



ORION

Orion Research Incorporated
Laboratory Products Group

THE SCHRAFFT CENTER
529 MAIN STREET, BOSTON, MA 02129
TEL 800-225-1480, 617-242-3900 / TLX 4430019
IN EUROPE: ORION RESEARCH AG
FAHNLIBRUNNENSTRASSE 3
CH-8700 KUSNACHT, SWITZERLAND
TEL 01 910 7858 / TLX 825767

OPERATING INSTRUCTIONS

CORNING

PS-15 pH METER

CATALOG NUMBER 475810

SPECIFICATIONS

Range: 0.0 - 14.0 pH

Accuracy: ± 0.2 pH

Resolution: 0.1 pH

Operating Temperature: 0 to 50°C

Battery: 3 x 1.4 V

(Duracell MP675H or equivalent)

Battery Life: 1000 hours

Size (L x W x H):

154 mm x 29 mm x 16 mm

Weight: 65 grams

OPERATION (refer to figure 1)

1. Remove protective cap from the bottom of the meter.
2. Turn on meter using ON/OFF switch.
3. Immerse meter to the level indicated in figure 1, approximately 1½ inches into the solution.

CAUTION: DO NOT IMMERSE ABOVE DISPLAY LEVEL

4. Stir gently and wait a few seconds for reading to stabilize.
5. Rinse the tip of the electrode in distilled or deionized water, blot dry and measure your next sample.
6. When not in use, turn switch "OFF" and replace the protective cap.

To improve meter performance, immerse the probe in tap water for a few minutes at least once a week.

CALIBRATION (refer to figure 2)

To calibrate the PS-15, immerse the probe in a known solution and adjust the reading using the trimmer located next to the pocket clip on the back of the unit.

BATTERY REPLACEMENT (refer to figure 2)

To change the batteries, carefully pull out the battery case and replace batteries.

PORTABLE SENSORS AVAILABLE FROM CORNING

PS-15 pH METER (Catalog Number 475810)

PS-16 THERMOMETER with "L" probe (Catalog Number 475811)

PS-17 CONDUCTIVITY METER (Catalog Number 475812)

PS-18 TDS METER (Catalog Number 475813)

PS-19 ORP METER (Catalog Number 475814)

CORNING TECHNICAL INFORMATION

1-800-222-7740

From NY or Canada: 1-607-974-4001

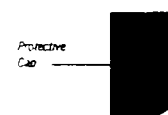
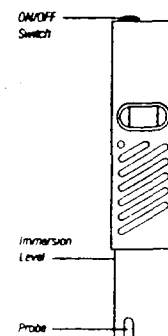


figure 1

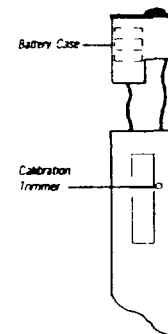


figure 2

MADE IN
MAURITIUS

IC-PS-15

pH Calibration & Measurement

General Calibration Procedure

For detailed calibration and temperature compensation procedures, consult your meter instruction manual.

Single-Buffer Calibration

1. Set up meter according to meter instruction manual.
2. Rinse electrode first with distilled water and then with the buffer being used for calibration (the buffer should be near the expected sample pH). Place the electrode in the buffer.
3. Wait for a stable display. Set the meter to the pH value of the buffer at its measured temperature. (A table of pH values at various temperatures is supplied on the buffer bottle.) See Table 1. Proceed to pH Measurement.

Two-Buffer Calibration

This procedure is recommended for precise measurements.

1. Select two buffers which bracket the expected sample pH. The first should be near the electrode isopotential point (pH 7) and the second near the expected sample pH (e.g., pH 4 or pH 10).
2. Rinse electrodes first with distilled water and then with pH 7 buffer. Place the electrode in pH 7 buffer.
3. Wait for stable display. Set the meter to the pH value of the buffer at its measured temperature. (A table of pH values at various temperatures is supplied on the buffer bottle.) See Table 1.

4. Rinse electrode first with distilled water and then with the second buffer. Place the electrode in the second buffer.
5. When display is stable, set meter to the actual pH value of the buffer as described in the meter instruction manual.
6. If all steps are performed correctly, and slope is between 92 and 102%, proceed to pH Measurement. If any of the above procedures does not work, refer to TROUBLESHOOTING.

Table 1
pH Values of NIST Buffers at Various Temperatures*

Nominal Value
at 25°C Temperature

	0°C	5°C	10°C	20°C	30°C
1.68	1.67	1.67	1.67	1.67	1.68
3.78	3.86	3.84	3.82	3.79	3.77
4.01	4.00	4.00	4.00	4.00	4.02
6.86	6.98	6.95	6.92	6.87	6.85
7.00	7.11	7.08	7.06	7.01	6.98
7.41	7.53	7.50	7.47	7.43	7.40
9.18	9.46	9.40	9.33	9.23	9.14
10.01	10.32	10.25	10.18	10.06	9.97

40°C	50°C	60°C	70°C	80°C	90°C
1.67	1.71	1.72	1.74	1.77	1.79
3.75	3.75				
4.03	4.06	4.08	4.13	4.16	4.21
6.84	6.83	6.84	6.85	6.86	6.88
6.97	6.97				
7.38	7.37				
9.07	9.01	8.96	8.92	8.89	8.85
9.89	9.83				

*NIST (National Institute of Standards and Technology) was formerly known as NBS.

pH Measurement

1. Calibrate the electrode as described in previous section.
2. Rinse the electrode with distilled water and then with sample.
3. Place the electrode in the sample.
4. When the display is stable, record sample pH.

SPECIFIC CONDUCTANCE MEASUREMENTS

TURBIDITY MEASUREMENTS

VII. CALIBRATION PROCEDURES

A. STANDARD FORMAZIN SOLUTIONS

Calibration of this instrument is based on Formazin, a material which can be made by synthesis and reproduced repeatedly within one percent. When properly mixed, it is uniform in the number, size and shape of its particles, thus making it an ideal turbidity standard. The unit of measure, and thus the calibration of this instrument is in Nephelometric Turbidity Units (NTU) based on Formazin.

Calibration samples may be obtained by diluting Formazin stock suspension using "Turbidity-Free" water. Formazin stock suspension may be prepared by the user (Reference A.W.W.A. "Standard Methods", 14th Edition) or it may be purchased in kit form, HF scientific part number 50040.

Each kit contains:

- 1 liter of 4000 NTU Stock Suspension
- 1 Gallon (3.79 liters) turbidity-free water
- 7 Sample cuvettes (28mm), with screw caps
- Instructions for dilution
- 1 200 μ l Pipette

The following table gives the recommended dilutions of the stock suspension. Be sure to adequately mix the stock suspension prior to removing a portion for dilution.

PROCEDURE

Value	Pipettes required	Pipette into a 200ml volumetric flask
198 NTU	10ml graduated in tenths of a ml	9.9ml of 4000 NTU stock. Add low turbidity water to 200 ml mark.
19.8 NTU	20ml volumetric	Pipette 20ml of the 198 dilution above into another 200ml volumetric flask. Add low turbidity water to the 200ml mark.
2.0 NTU	2.0ml volumetric	Pipette 2.0ml of the 198 dilution into a 200ml volumetric flask. Add low turbidity water to the 200ml mark. NOTE: Value includes 0.02 NTU added by the water.

NOTE: 1. When the prepared samples start to flocculate, they are unreliable and fresh ones must be made. This will occur more rapidly for the lower value diluted suspensions.

B. ELECTRONIC CALIBRATION USING FRESHLY PREPARED FORMAZIN SOLUTIONS

The DRT Turbidimeters have been carefully calibrated by the factory. However, should the Electronic P.C. Board, the Photo Detectors, or the Light Source be replaced or if very carefully prepared Formazin suspensions indicate a need for recalibration, this may be easily accomplished in your facility.

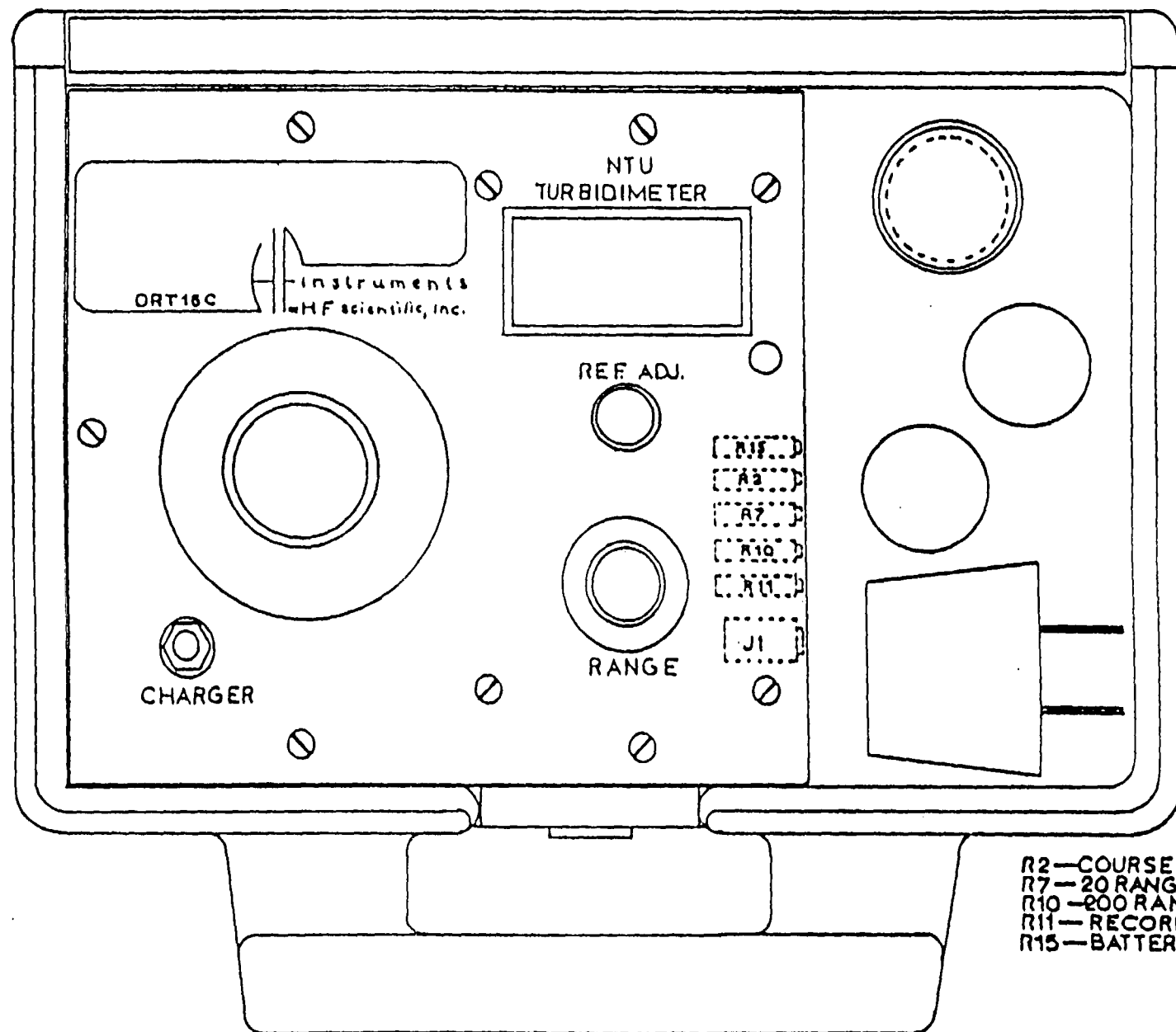
To carry out a complete calibration the following Formazin suspension values are required:

- | | | |
|-----------|---|------------------------------------|
| 198 NTU, | - | Fill, cap and label a separate |
| 19.8 NTU | | cuvette with a sample of each. |
| & 2.0 NTU | - | |
| | - | Always mix the contents of each |
| | | cuvette by inverting several times |
| | | before placing in the Optical Well |
| | | for a reading. |
| | - | Keep the outside surface of |
| | | cuvettes clean. |
| | - | When placing any standards in the |
| | | well, always use the Light Shield |
| | | to cover the well in order to keep |
| | | out ambient light. |

To gain access to the trimpots, remove the accessories from the foam holder. Refer to figure 2 for trimpot identification during the next few steps.

- 1) Center the reference adjust control on top of the instrument.
- 2) Insert the reference standard and turn the range control on the DRT-15C to the 20 range. Adjust the "Course Zero" trimpot (R2) until a reading of 0.02 NTU is obtained.
- 3) Replace the reference standard with the 19.8 formazin standard and adjust the "20 Range Adjust" trimpot (R7) to obtain a reading of 19.8 NTU \pm 0.1 NTU.
- 4) Replace the 19.8 NTU formazin standard with the reference standard and adjust the reference adjust control to obtain a reading of 0.02 NTU.
- 5) Repeat steps 3 and 4 until no further adjustments are required.
- 6) The 2.0 NTU Formazin Standard may be used to check calibration for low readings.
- 7) Turn the range control on the DRT-15C to the 200 range. Insert the 198 NTU formazin standard and adjust the "200 Range Adjust" trimpot to obtain a reading of 198 \pm 1 NTU.

This completes the calibration of the DRT-15C.



R2—COURSE ZERO ADJ.
R7—20 RANGE ADJ.
R10—200 RANGE ADJ.
R11—RECORDER ADJ.
R15—BATTERY SET

How It Works

1. Place the supplied HF factory certified secondary reference standard in the optical well and set reference adjustment knob to read 0.02 NTU.
2. Next, place one of the three supplied HF certified alternative primary standards in the optical well and adjust the low calibration control to read the certified primary value of 0.50 NTU.
3. Affix the certification seal to your HF turbidimeter with date calibrated and signature.
4. Now just repeat every four months.

Ordering Information

Calibration Kit	Catalog Number	Price
DRT-15B, DRT 100B (portable laboratory)	19885	\$149/kit
DRT-200, Micro-T	19886	\$149/kit

For other models contact our factory

Kit Advantages

Regulatory Compliance

Approved by EPA, standard method ASTM AEPA-1 (method 180.1 Federal Register Nephelometric Standard Method (Volume 16), ASTM (D1889-88a).

Economy

Full one year supply for one low price. Safe for your personnel; harmless to our environment.

Convenience

Eliminates formulation and preparation time and error; never needs mixing.

Stability

Does not deteriorate; will not settle out; long shelf life.

Accuracy

Guaranteed reproducible to $\pm 1\%$.

Description

Each kit comes with:

- Deluxe polyethylene foam carrying case
- 1 ea. sealed reference standard
- 1 ea. special index light shield
- 3 ea. 28mm cuvettes 0.5 NTU certified alternative primary calibrating standards
- 3 ea. selected measuring cuvettes
- 3 ea. certification stickers
- 1 ea. factory registration card
- 1 ea. instruction manual

Local Representative:

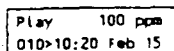


HF scientific, inc.

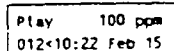
3052 Metro Parkway S.E., Fort Myers, FL 33916-7539
Phone: (813) 337-2116 FAX: (813) 332-7643

PHOTOIONIZATION DETECTOR

Chapter 2 Operation



Play 100 ppm
010:10:20 Feb 15



Play 100 ppm
012:10:22 Feb 15



measuring and recording real time concentrations even though the instrument status is "Play". If, during playback, an instrument status with a priority higher than that of "Play" is encountered in real time operation it will be displayed, but MicroTIP will continue to play back.

Playback speed can be increased or decreased by pressing the arrow keys. Information can also be viewed in the opposite direction, again, by pressing the arrow keys. A forward arrow (>) appears in the display if data are being played forward or a backward arrow (<) if the data are being played in reverse.

Press ENTER to freeze the display at any time and use the arrow keys to resume playback. Press EXIT to return to the normal display.

The PLAY function provides a speed search to find the desired start and stop Event numbers for printing or graphing.

2.14 CAL

MicroTIP must be calibrated in order to display concentration in units equivalent to ppm. First a supply of zero air, which contains no ionizable gases or vapors, is used to set MicroTIP's zero point. Then, span gas, containing a known concentration of a photoionizable gas or vapor, is used to set the sensitivity.

Usually clean ambient air will be suitable as zero air. If there is any doubt, use a commercial source of zero grade air and a second sampling bag. Span gas of the desired compound and concentration, required for calibration, may be obtained from a specialty gas supplier. See Appendix B.

Isobutylene at 100 ppm in air is recommended as span gas. To calibrate the instrument use the Calibration Kit (Photovac Part No. 390033) as follows:

1. Connect the supplied regulator to the span gas cylinder. Hand tighten the fittings. Observe proper handling techniques for all gases.

Chapter 2 Operation

Cal memory ? $\uparrow\downarrow$
7

Response factor?
1.00

Connect zero gas
then press ENTER

Calibrating now,
please wait...

Span conc ? ppm
100.00

Connect span gas
then press ENTER

Calibrating now,
please wait...

2. Open the valve on the gas bag by turning the valve stem fully counterclockwise.
3. Attach the nut to the regulator. Hand tighten the fittings.
4. Turn the regulator knob counterclockwise about half a turn to start the flow of gas.
5. Fill the gas bag about half full and then close the regulator fully clockwise to turn off the flow of gas.
6. Disconnect the bag from the adapter and empty it. Flush the bag a few times with the span gas and then fill it.
7. Close the gas bag by turning the valve clockwise.
8. Press SETUP and select the desired Cal Memory with the arrow keys and press ENTER. Press EXIT to leave Setup.
9. Press CAL and enter the desired response factor. Use Table 2, on page 21, to find the correct response factor for the compound of interest. If the compound is not in Table 2 or you are not looking specifically for one compound then enter 1.00.

The concentration detected by MicroTIP will be multiplied by the response factor before it is displayed and logged.
10. Expose MicroTIP to zero air. Press ENTER and MicroTIP sets its zero point.
11. MicroTIP then asks for the span gas concentration. Enter the known span gas concentration and then connect the span gas bag adapter to the inlet.
12. Press ENTER and MicroTIP sets its sensitivity.
13. When MicroTIP's display reverts to normal, MicroTIP is calibrated and ready for use. Remove the span gas bag from the inlet.

Chapter 2 Operation

MicroTIP has 10 Cal Memories and can be calibrated with 10 different span gases or response factors if desired. Only one Cal Memory can be used at a time. Each memory stores a different response factor, zero point and sensitivity. To program the Cal Memories:

1. Press SETUP and select the desired Cal Memory (1 to 10) with the arrow keys.
2. Exit from SETUP and press the CAL key.
3. Enter the desired response factor and press ENTER.

Note: It does not matter which Cal Memory is selected or which response factor is entered, MicroTIP's response is not specific to any one compound. The reading displayed represents the total concentration of all photoionizable compounds in the sample.

4. Follow the displayed calibration instructions. When the calibration is completed it is automatically stored in the selected Cal Memory. The span gas concentration entered here is specific to the selected Cal Memory.

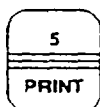
Whenever the instrument is calibrated, MicroTIP updates the selected Cal Memory only. The instrument should be calibrated at least once a day.

2.15 PRINT

MicroTIP was designed to be used with an Epson® FX-80 or 100% compatible printer with an RS232 serial interface. If an Epson FX-80 compatible printer is to be used, the printer cable and suitable adapter (Photovac Part No. 395006) should work.

The printer must be set to 8 data bits and 1 stop bit to communicate with MicroTIP. MicroTIP's baud rate and parity must be set depending on the printer requirements. Refer to the printer user's manual for more information.

MicroTIP is not UL-classified for use in hazardous locations with printers.



FLAME IONIZATION DETECTOR

CALIBRATION

Primary Calibration for Methane

Internal electronic adjustments are provided to calibrate and align circuits. After initial factory calibration, it should not be necessary to repeat calibration unless analyzer undergoes repairs which affect calibration. If OVA 128 will be used extensively for analysis of a sample other than methane, recalibration of the electronics (after resetting the GAS SELECT dial) may result in better accuracy. See Recalibration to Various Organic Vapors above.

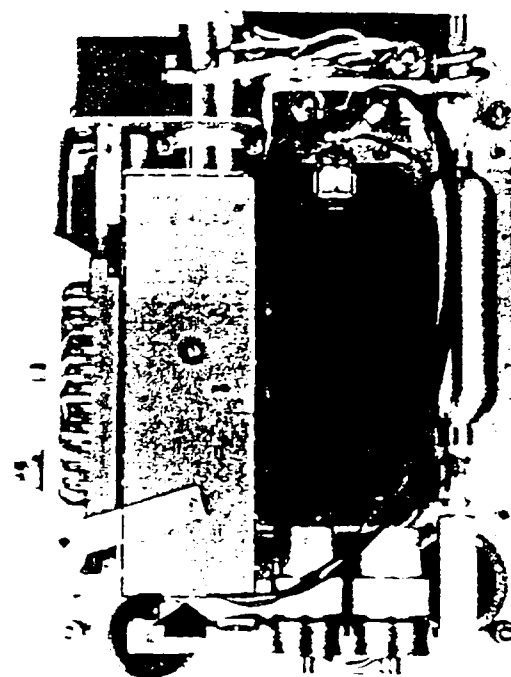
Primary calibration of this instrument is accomplished at the factory using methane-in-air sample gases. Methane-in-air calibration kits are available from Foxboro.

For more accuracy on the X100 scale, a 950 to 980 ppm sample of methane should be introduced. Fine tune R33 on printed wiring board assembly (see Figure 4).

Calibration Using Known Samples for Each Range (Refer to Figure 4)

The accuracy stated under Specifications is obtained when the instrument is calibrated with known concentrations for each range. Prepare separate samples of Methane-in-air in these concentration ranges: 7 to 10 ppm, 90 to 100 ppm, and 900 to 1000 ppm. Calibrate the instrument as follows:

1. Place the instrument in normal operation and allow a minimum of 20 minutes for warm-up and stabilization; then zero out the ambient air.
2. Set the GAS SELECT dial to 300.
3. Set the CALIBRATE Switch to X10.
4. Set the CALIBRATE ADJUST (Zero) knob so that the meter reads zero.
5. Check that the meter reads zero on the X100 and X1 ranges.
6. Set the CALIBRATE Switch to X1 and introduce the sample with known concentration in the 7 to 10 ppm range.
7. Adjust R31 so that the meter reading corresponds to the sample concentration.
8. Set the CALIBRATE Switch to X10 and introduce the sample with known concentration in the 90 to 100 ppm range.
9. Adjust R32 so that the meter reading corresponds to the sample concentration.
10. Set the CALIBRATE Switch to X100 and introduce the sample with known concentration in the 900 to 1000 ppm range.



R-31 R-32 R-33 R-38

Figure 4.
Location of Electronic Trimpot Adjustments

11. Adjust R33 so that the meter reading corresponds to the sample concentration.
12. The instrument is now calibrated for methane and ready for use.

Calibration Using a Single Sample Calibration (Refer to Figure 4)

Calibration may be accomplished using a single known sample of methane in air in the range of 90 to 100 ppm. This may not provide the accuracy stated under specifications but is adequate for field survey work.

1. Place instrument in normal operation with CALIBRATE Switch set to X10 and GAS SELECT dial set to 300, and allow 20 minutes for warm up and stabilization.
2. Use the CALIBRATE ADJUST (zero) knob to adjust the meter reading to zero.
3. Introduce a methane sample of a known concentration (between 90 and 100 ppm, not to exceed 100 ppm) and adjust trimpot R32 so the meter reading corresponds to the known sample.
4. Extinguish the flame by blocking the exhaust ports.
5. Leave CALIBRATE Switch on X10 position and use CALIBRATE ADJUST (zero) knob to adjust Readout meter reading to 4 ppm.

6. Move the CALIBRATE Switch to the X1 position and using trimpot R31, adjust Readout meter reading to 4 ppm.
7. Move CALIBRATE Switch to X10 position again. Use CALIBRATE ADJUST (zero) knob to adjust Readout meter to 40 ppm.
8. Move CALIBRATE Switch to X100 position and use trimpot R33 to adjust Readout meter to 40 ppm.
9. Move CALIBRATE Switch back to X10 scale. Rezero Readout meter to 0 ppm; reignite instrument.
10. Unit is now balanced over the full range, calibrated to methane, and ready to be placed in normal service.

Recalibration to Various Organic Vapors

NOTE

In order to reduce error, test sample must be prepared in the same background air as was present when the instrument was "zeroed".

The OVA 128 is capable of responding to nearly all organic compounds. At the time of manufacture, the analyzer is calibrated to mixtures of methane in air. For precise analysis it is necessary to recalibrate with the specific compound of interest. The GAS SELECT dial is used to set the electronic gain for a particular compound.

The instrument is recalibrated using a known concentration of a specific vapor in air. After the instrument is in operation and the normal background is zeroed, draw a sample of the calibration gas into the instrument. The GAS SELECT dial on the panel is then used to set the readout meter indication to correspond to the concentration of the calibration gas mixture.

The instrument has now been calibrated to the vapor mixture being used. After this adjustment, the setting on the GAS SELECT dial, and instrument serial number should be recorded for that particular organic vapor compound. This exercise can be performed for a large variety of compounds, thereby generating a "library" which can be used for future reference without need for additional calibration standards.

NOTE

Direct readout to the selected compound is valid only within the range in which the response is linear, and for the specific instrument for which calibration was performed.

To read a particular compound, the GAS SELECT dial is turned to the predetermined setting for the compound. Calibration on any one range automatically calibrates the other two ranges.

Using Empirical Data

Relative response data can be used to estimate the concentration of a vapor without need to recalibrate the analyzer. With the instrument calibrated to methane, obtain the concentration reading for a calibration sample of the test vapor. The relative response (R) in percent for that vapor is:

$$R(\text{in } \%) = \frac{\text{Measured Concentration}}{\text{Actual Concentration}} \times 100$$

NOTE

The actual concentration can be determined by merely dividing the measured concentration by the relative response (expressed as a decimal).

The EPA quantifies detector sensitivity by utilizing a "Response Factor" for each compound, rather than a relative response in %.

where:

$$\text{Response Factor} = \frac{\text{Actual Concentration}}{\text{Measured Concentration}}$$

To determine the concentration of an unknown sample of that vapor, multiply the measured concentration by the Response Factor.

Calibration Standards

Commercial Standards

Commercially available standard samples offer the most convenience and are recommended for the most precise analyses. Always remember to obtain the desired vapor in an ambient air background. Samples should be drawn from the cylinder into a collapsed sample bag, then drawn from the bag by the instrument to prevent a pressure or vacuum at the sample inlet.

**Standard Operating Procedure
for
PCB Immunoassay Screen Tests
Willow Brook and Willow Brook Pond
PCB Remediation**



3.1 Overview

Soil samples are collected and PCB is extracted. Then sample extracts, calibrators, and reagents are added to cuvettes coated with antibodies specific for PCB. The resultant color is measured with a Hach Pocket Colorimeter. The concentration of PCB in a sample is determined by comparing the developed color intensity to that of a PCB calibrator. The PCB concentration is inversely proportional to the color development: the lighter the color, the higher the PCB concentration.

This method provides semi-quantitative screening based on thresholds for PCB in the following concentrations: 1 ppm, 5 ppm, 10 ppm and/or 50 ppm.

3.2 Testing Hints

1. **Read the entire procedure before starting.** Identify and have ready all the necessary reagents, cuvettes, and other apparatus before beginning the analysis.
2. **Timing is critical;** follow instructions carefully.
3. **A consistent technique when shaking the cuvettes is critical to this test.** Using the cuvette rack and shaking as described in the procedure yields the best results. Cuvettes can be shaken individually, but test results may not be as consistent.
4. The test requires about 15 minutes for complete analysis. As many as 10 cuvettes can be run simultaneously.
5. Handle the cuvettes carefully. Scratches on the inside or outside may cause erroneous results. Clean the outside of the cuvettes with a clean absorbent cloth or tissue before placing them into the instrument. (Kimwipe® tissues are provided with the kit.)
6. Antibody cuvettes and enzyme conjugate are made in matched lots. Do not mix reagent lots.

SECTION 3, continued

7. Cuvettes should fit snugly into the cuvette rack. Do not force the cuvettes into the rack as they may be difficult to remove and the contents may spill.
8. The cuvette rack is designed to be inverted with the cuvettes in place. This is especially helpful when running many samples at once; the cuvettes can remain in the rack and be processed together until they are read in the Immunoassay Pocket Colorimeter. (See *Measuring Color*.)
9. Five Zeroing Cuvettes are provided with each reagent set. The Zeroing Cuvettes can be re-used.
10. Twenty Antibody Cuvettes are provided with each reagent set. One Antibody Cuvette will be used for each calibrator and each sample. Antibody Cuvettes are not reusable.
11. The Immunoassay Pocket Colorimeter provides a reading in terms of "counts." This is a general unit of measurement that will allow you to compare your samples to the calibrators.
12. To avoid damaging the Color Developing Solution, do not expose it to direct sunlight.
13. The Soil Extractant contains methyl alcohol which is poisonous and flammable. Read the Material Safety Data Sheet (MSDS) before using this and other reagents.
14. There are two protocols in this procedure, one for levels of 1 ppm and 5 ppm, and another for 10 ppm and 50 ppm. Each uses a different quantity of standard and sample extract as follows:

Range	Quantity of standard and sample extract used
1 ppm and 5 ppm	50 μ L
10 ppm and 50 ppm	10 μ L

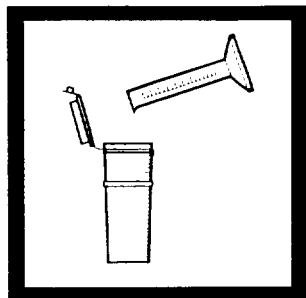
15. To test across ranges, such as 1 and 50 ppm, test the lower concentration first. If the result is positive then test at the higher level. If the result of the test at the lower concentration is negative, the higher range test will be negative also, and need not be performed.

SECTION 3, continued

16. The same extract can be used for both protocols if it is capped between assays.

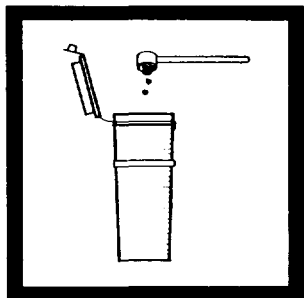
SECTION 3, continued

3.3 Soil Extraction

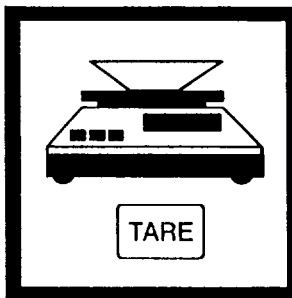


1. Use the graduated cylinder to transfer 10 mL of soil extractant into an extraction vial.

Note: Read Section 3.2, Testing Hints before testing.

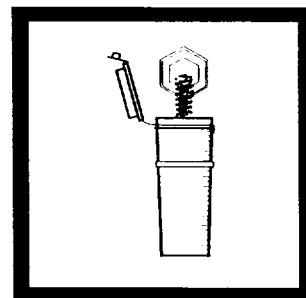


2. Use the 5 g scoop to add one scoop of sodium sulfate to the extraction vial.

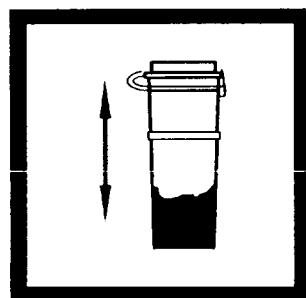


3. Place a plastic weighing boat on the AccuLab balance. Zero the balance.

Note: Refer to the AccuLab Instructions for balance operation.



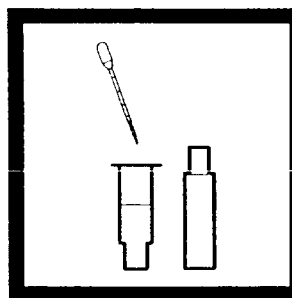
4. Weigh out 5.0 g of soil in the plastic weighing boat. Carefully pour the soil into the extraction vial.



5. Cap the extraction vial tightly and shake vigorously for one minute.



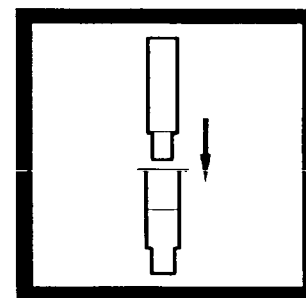
6. Allow to settle for at least one minute. Gently open the extraction vial.



7. Using the disposable bulb pipet, withdraw 1.0–1.5 mL from the liquid layer at the top of the extraction vial.

Transfer it into the filtration barrel (the bottom part of the filtering assembly into which the plunger inserts).

Note: Do not use more than 1.5 mL. The bulb is marked in 0.25-mL increments



8. Insert the filtration plunger into the filtration barrel. Press firmly on the plunger until at least 0.5 mL of sample extract is forced upward into the center of the plunger.

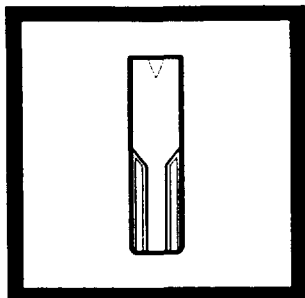
Note: It may be necessary to place the filtration assembly on a table and press down on the plunger.

Note: This extract can be used for testing at all calibrator levels.

SECTION 3, continued

3.4 Procedure

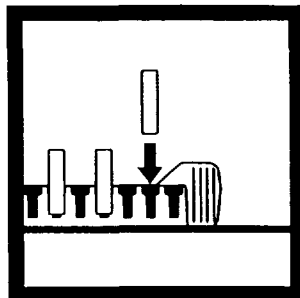
Immunoassay



1. Label an Antibody Cuvette for each Calibrator to be used. Label a cuvette for each sample to be tested.

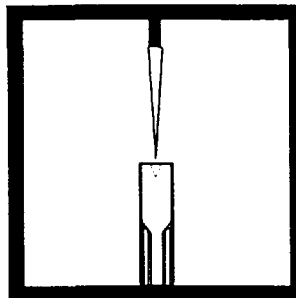
Note: As many as 10 cuvettes may be tested at one time.

Note: See Section 3.2, Testing Hints



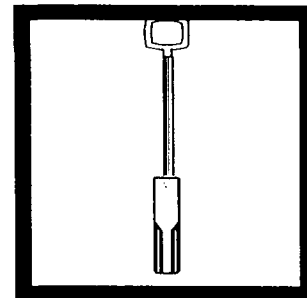
2. Place the cuvettes into the rack snugly.

Note: Cuvettes should remain in the rack when it is inverted and tapped gently.



3. Pipet 0.5 mL of assay diluent into each cuvette.

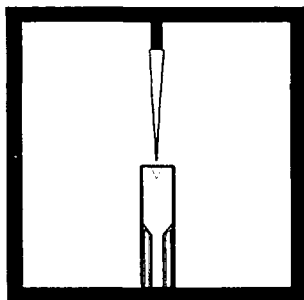
Note: The same pipette tip can be used repeatedly for this step.



4. Use a WireTrol™ pipet to transfer the appropriate volume of Calibrator and extract into each cuvette.

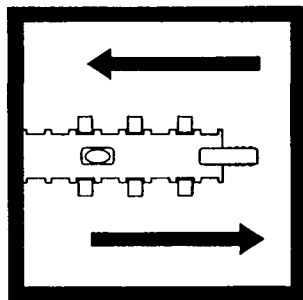
Note: When testing at the 1 ppm and/or 5 ppm levels use 50 μ L of calibrator and sample. When testing at the 10 ppm and/or 50 ppm levels, use 10 μ L of calibrator and sample.

SECTION 3, continued



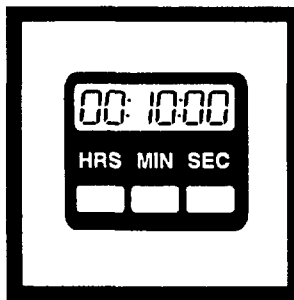
5. Immediately pipet 0.5 mL of PCB Enzyme Conjugate into each cuvette.

Note: The same pipette tip can be used repeatedly for this step.



6. Set the rack on a hard, flat surface that is at least twice the length of the rack.

Holding one end of the rack, slide it back and forth along its long axis for 30 seconds to mix. The rack should move through a distance equal to its length in each direction.



7. Begin a 10-minute reaction time.

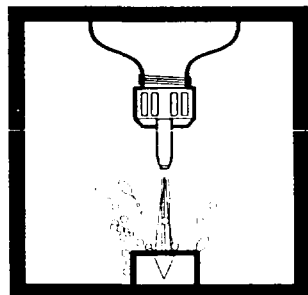
When 5 minutes have passed, shake the rack for 20 seconds as described in step 6.

Note: Time this step carefully.



8. After the 10-minute period, discard the contents of all the cuvettes. Use an appropriate waste container.

Note: If all the cuvettes are snugly fitted into the rack, they may be emptied simultaneously by inverting the rack over the waste container.



9. Wash each cuvette forcefully and thoroughly four times with deionized water. Empty the cuvettes into the waste container.

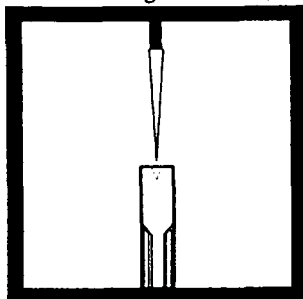
Note: Ensure most of the water is drained from the cuvettes by turning the cuvettes upside down and gently tapping them on a paper towel to drain.

Note: Rinsing may be done with the cuvettes still in the rack.

SECTION 3, continued

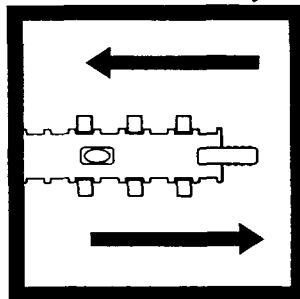
Color Development

Note: Timing is critical; follow instructions carefully



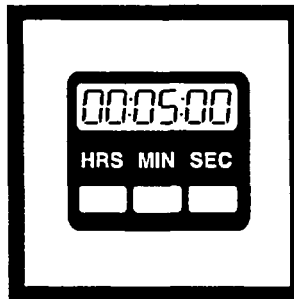
10. With the cuvettes still held snugly in the rack, pipet 0.5 mL of Color Developing Solution into each Antibody Cuvette.

Note: Use a new pipette tip for each cuvette.



11. Set the rack on a hard, flat surface that is at least twice the length of the rack.

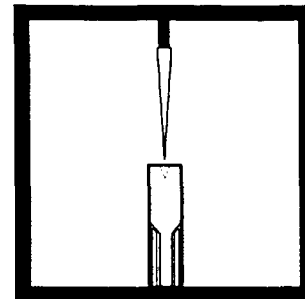
Holding one end of the rack, slide it back and forth along its long axis for 30 seconds to mix. The rack should move through a distance equal to its length in each direction.



12. Begin a 5-minute reaction period.

After 2.5 minutes have passed, slide the rack for 20 seconds using the technique described in step 11.

Note: Solutions will turn blue in some or all of the cuvettes.



13. At the end of the 5-minute reaction period, pipette 0.5 mL of Stop Solution into each cuvette in the same order as the Color Developing Solution was added.

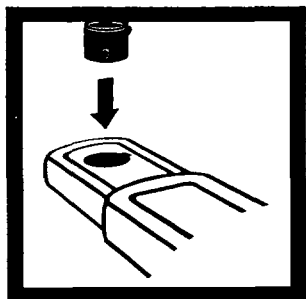
Slide the rack for 20 seconds using the technique described in step 11.

Note: Blue solutions will turn yellow with the addition of the Stop Solution.

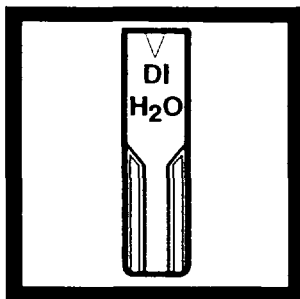
Note: The same pipette tip can be used repeatedly for this step.

SECTION 3, continued

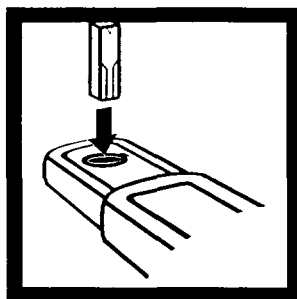
Measuring the Color



14. Insert the 1-cm MicroCuvette Adapter into the instrument by aligning the tabs on the adaptor with the slots in the right side of the cell holder.

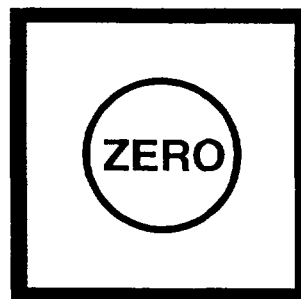


15. Label and fill a Zeroing Cuvette with deionized water. Wipe the outside of all the cuvettes with a tissue to remove water, smudges, and fingerprints.



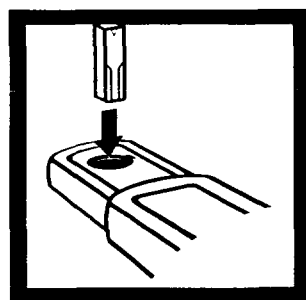
16. Insert the Zeroing Cuvette into the adapter. Cover the zeroing cuvette with the instrument cap.

Note: The arrow at the top of the cuvette should always face forward.

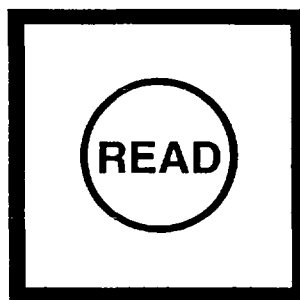


17. Press: **ZERO**. The instrument display will turn on and the display will show ---, followed by 0.

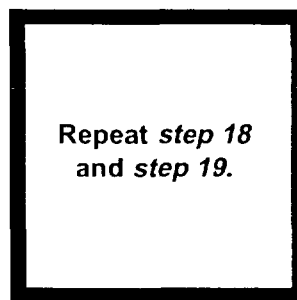
Once the display shows zero, remove the zeroing cuvette, but leave the adapter in place.



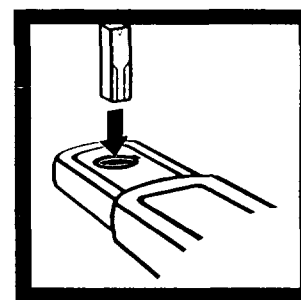
18. Insert the first PCB calibrator into the cell holder. Cover the cuvette with the instrument cap.



19. Press: **READ**. Record the count value displayed. Hold the adapter in place when removing the cuvette.

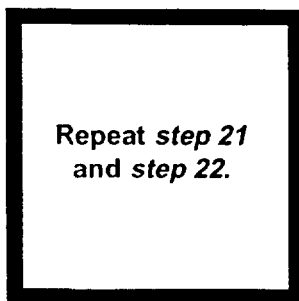
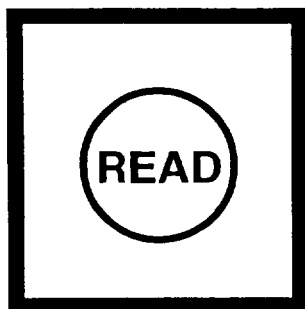


20. Repeat step 18 and step 19 for any remaining calibrators, as required.



21. Insert the first sample cuvette into the cell holder. Cover the cuvette with the instrument cap.

SECTION 3, continued



22. Press: **READ**.
Record the count value displayed. Hold the adapter in place when removing the cuvette.

23. Repeat *step 21* and *step 22* for all of the remaining samples.

Note: *Flashing 0 indicates PCB concentrations much greater than the calibrators. Flashing 990 indicates PCB concentration much less than the calibrators.*

SECTION 3, continued

3.5 Interpreting the Results

There is an inverse relationship between the concentration of PCB and the count. In other words, the higher the count value, the lower the concentration of PCB.

If the sample count is...	Sample PCB Concentration is...
...less than calibrator count	...greater than the calibrator value
...greater than calibrator count	...less than the calibrator value

Example:

1 ppm PCB Calibrator: 340 counts

5 ppm PCB Calibrator: 175 counts

Sample #1: 100 counts

Sample #2: 250 counts

Sample #3: 500 counts

Sample #1 — Sample count is less than the counts for both calibrators. Therefore the sample concentration is greater than 1 ppm and greater than 5 ppm as Aroclor 1248.

Sample #2 — Sample count is between the counts for the 1 ppm and the 5 ppm PCB calibrators. Therefore the concentration of PCB is between 1 ppm and 5 ppm PCB as Aroclor 1248.

Sample #3 — Sample count is greater than the counts for both calibrators. Therefore the sample concentration is less than 5 ppm and less than 1 ppm PCB as Aroclor 1248.

3.6 Storing and Handling Reagents

- Wear protective gloves and eyewear.
- When storing reagent sets for extended periods of time, keep them out of direct sunlight. Reagent shelf life can be extended by refrigerating the reagents and is strongly recommended.

SECTION 3, continued

- Keep the foil pouch containing the PCB Antibody Cuvettes sealed when not in use.
- If Stop Solution comes in contact with eyes, wash thoroughly for 15 minutes with cold water and seek immediate medical help.

3.7 Sensitivity

The PCB immunoassay cannot differentiate between the various Aroclors, but it detects their presence in differing degrees.

Compound	Concentration (ppm) to give a positive result at			
	1 ppm	5 ppm	10 ppm	50 ppm
1248	1	5	10	50
1016	2	9	20	67
1242	1.2	6	14	50
1254	1.4	4.6	11	28
1260	1.1	4.9	11	38

The following compounds are not detectable at 1000 ppm.

Biphenyl	2,4,6-trichlorophenyl	1,3-dichlorobenzene
2,4-dichlorophenyl	pentachlorophenol	1,4-dichlorobenzene
2,4,5-trichlorophenyl	1,2-dichlorobenzene	1,2,4-trichlorobenzene

3.8 Sample Collection and Storage

Collect samples in glass or Teflon[®] containers that have been washed with soap and water and rinsed with methanol. The container should be capped with a Teflon-lined cap. If a Teflon cap is not available, methanol-rinsed aluminum foil may be used as a substitute cap liner.

3.9 Summary of Method

Hach immunoassay tests use antigen/antibody reactions to test for specific organic compounds in water and soil. PCB-specific antibodies, attached to the walls of plastic cuvettes, selectively bind and remove PCB from complex sample matrices. A prepared sample and a reagent containing enzyme-conjugate molecules (analyte molecules attached to molecules of an enzyme) are

SECTION 3, continued

added to the Antibody Cuvettes. During incubation, enzyme-conjugate molecules and PCB compete for binding sites on the antibodies. Samples with higher levels of analyte will have more antibody sites occupied by PCB and fewer antibody sites occupied by the enzyme-conjugate molecules.

After incubation, the sample and unbound enzyme conjugate are washed from the cuvette and a color-development reagent is added. The enzyme in the conjugate catalyzes the development of color. Therefore, there is an inverse relationship between color intensity and the amount of PCB in the sample. The resulting color is then compared with a calibrator to determine whether the PCB concentration in the sample is greater or less than the threshold levels.

Required Reagents

Description	Unit	Cat. No.
Reagent Set, PCB in Soil*	20 cuvettes	27735-00

Required Apparatus

Adapter, MicroCuvette, 1-cm	each	48798-00
Battery, alkaline AAA 1.5 volts	4/pkg	46743-00
Caps, flip spout	2/pkg	25818-02
Marker, laboratory	each	20920-00
Pipettor, fixed volume, 0.5-mL	each	27641-00
Tips, for pipettor 27641-00	100/pkg	27642-00
Pocket Colorimeter, Immunoassay	each	46770-30
Rack, for 1-cm Micro Cuvettes	each	48799-00
Talking Timer, Sper Scientific	each	27644-00
Wipes, disposable	box	20970-00

Optional Reagents

Reagent Set, PCB	100 cuvettes	XXXXXX-XX
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* Immunoassay components are manufactured for Hach Company by Beacon Analytical Systems, Inc.

DATA SHEET — For PCB in Soil Test Kit*

Location: _____

Date of Testing: _____

Operator: _____

Lot Number of Reagent Set: _____

Serial Number of Immunoassay Pocket Colorimeter: _____

CALIBRATORS

Calibrator Value	Counts	Comments

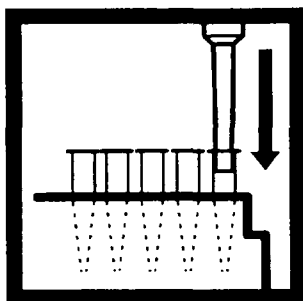
SAMPLES

Sample Number	Counts	Interpretation	Comments

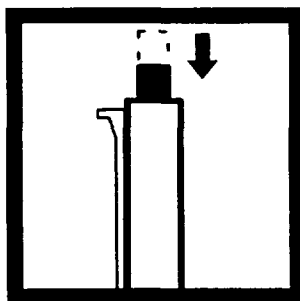
* This page may be duplicated as needed.

SECTION 2, continued

Using the Precision Pipettor

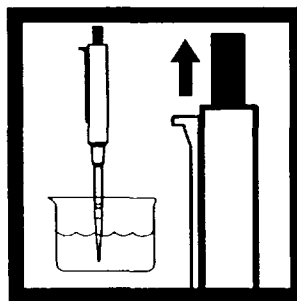


1. Press a pipette tip firmly onto the fixed-volume Precision Pipettor.



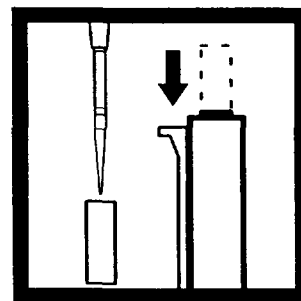
2. Depress the plunger gently to the first stop.

Note: This is approximately half way. Do not depress the plunger past this first stop or measured quantities may be inaccurate and the Pipettor body may be damaged.



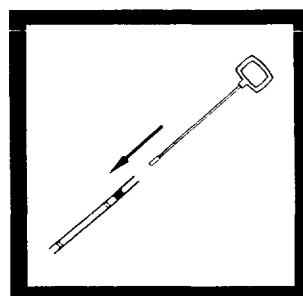
3. With the tip immersed in the solution to be pipeted, allow the plunger to return slowly to its original position

Note: Do not let the plunger snap into place. This will decrease accuracy.

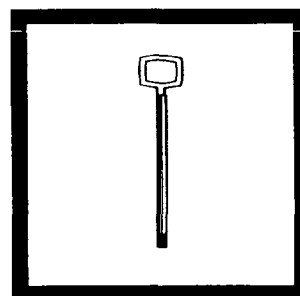


4. Position the Pipettor tip over the receiving vessel. Depress the plunger fully (past the stop) to dispense the sample. Allow the plunger to return slowly to the starting position.

2.3 Using the WireTrol™ Pipet

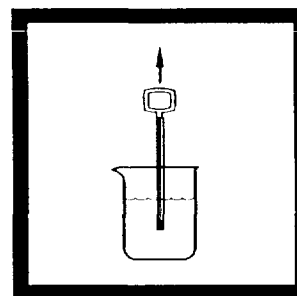


1. Gently insert the orange-tipped end of the WireTrol plunger into the end of the capillary tube with the colored band on it.

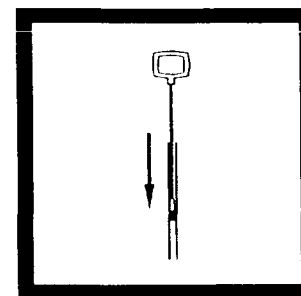


2. Push the tip to the other end of the capillary tube until it barely extends beyond the end of the capillary tube.

Note: The pipet will operate more freely after the Teflon® tip is wetted.



3. Submerge the capillary tube below the sample or standard surface. Slowly and smoothly draw the WireTrol plunger up until the bottom of the plunger tips reaches the appropriate volume line. Touch the end of the tube to the side of the vessel to release drops on the capillary tube tip.



4. To discharge the pipet, place the tip of the capillary tube below the surface of the solution and push the WireTrol plunger down in one smooth motion. Change capillary tubes for each standard and sample.

Appendix C

CTDEP General Permit for the Discharge of Groundwater Remediation Wastewater to the Sanitary Sewer



STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER MANAGEMENT
PERMITTING, ENFORCEMENT & REMEDIATION DIVISION
(860) 424-3018

General Permit for the Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer

Issuance Date:
August 13, 1996

Printed on recycled paper

General Permit for the Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer

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General Permit for the Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer

Section 1. Authority

This general permit is issued under the authority of Section 22a-430b of the General Statutes.

Section 2. Definitions

The definitions of terms used in this general permit shall be the same as the definitions contained in Section 22a-423 of the General Statutes and Section 22a-430-3(a) of the Regulations of Connecticut State Agencies. As used in this general permit, the following definitions shall apply:

"Aquifer Protection Areas" are areas that contribute water to public water supply wells as defined in Section 22a-354h(10) of the General Statutes.

"Best Management Practices" (BMP) means a practice, procedure, structure or facility designed to prevent or minimize environmental damage, or to maintain or enhance environmental quality. BMPs may include treatment requirements, operating procedures, practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage, practices to provide necessary streamflow in surface waters and minimize or avoid adverse impacts to adjacent wells, fish and wildlife.

"Coastal Boundary" shall be as defined in Section 22a-94(b) of the General Statutes.

"Department" means the Department of Environmental Protection.

"Endangered Species Area" means any area designated on maps produced by the DEP, entitled, "State and Federal Listed Species and Natural Communities."

"Groundwater Remediation Wastewater" means wastewater generated during the process of investigating and remediating groundwater and soil, including but not limited to groundwater from a recovery well, water which collects in an excavation, foundation drain or other subsurface structure, water that results from a tank removal, well development wastewater, well purging wastewater or sampling wastewater, pump test wastewater, washdown or backwash wastewater for treatment systems necessary to remediate the groundwater and soil, and wastewaters associated with the maintenance of a remediation system, and wastewater or condensate from construction or maintenance of soil vapor extraction systems.

"Liquid" means flowing freely like water, characterized by free movement of constituent molecules among themselves, without the tendency to separate.

"Oil and Grease - Hydrocarbon Fraction Analysis" shall in this general permit be conducted according to EPA Method 413.1 (Oil and Grease, Total, Recoverable), modified using silica gel adsorbent to remove interferences as specified in EPA Method 418.1.

"Oil or Petroleum" means oil or petroleum of any kind in liquid form including but not limited to waste oils and distillation products such as fuel oil, kerosene, naphtha, gasoline and benzene.

"Permittee" means any person who or municipality which initiates, creates, originates or maintains a discharge in accordance with Section 3 of this general permit.

"POTW Authority" means the chairperson or responsible official of the Water Pollution Control Authority which owns or operates a Publicly Owned Treatment Works.

"Recovery Well" means a well used for pumping contaminated groundwater.

"Registrant" means a person who or municipality which submits a registration in accordance with Section 4 of this general permit.

"Registration" means a completed registration form and registration fee submitted to the Commissioner pursuant to Section 4 of this general permit.

"Remote Site" means a property, on which a groundwater remediation system is installed, but no other activity is performed and the property is otherwise abandoned.

"Screening Analysis" means the analysis performed prior to submittal of the General Permit Registration Form and at regular intervals thereafter in accordance with Section 4 of this general permit.

"Site" means geographically contiguous land on which an authorized activity takes place or on which an activity for which authorization is sought under this general permit is proposed to take place. Non-contiguous land or water owned by the same person and connected by a right-of-way which such person controls and to which the public does not have access shall be deemed the same site.

"Tentatively Identified Compounds" means compounds detected in samples that are not target compounds, internal standards, system monitoring compounds or surrogates.

"Tidal Wetlands" shall be as defined in Section 22a-29(2) of the General Statutes.

"Well development wastewater" means wastewater generated by the pumping of water production wells to enhance yields through the removal of scale and other fine materials from the sides of the wells.

"Well purging wastewater" means wastewater generated by the removal of standing waters from a well to encourage the inflow of surrounding groundwaters.

Section 3. Authorization Under this General Permit

(a) Requirements for Authorization

This general permit authorizes only discharges comprised solely of groundwater remediation wastewater provided:

- (1) The discharge is *not* authorized by a valid individual permit issued under Section 22a-430 of the General Statutes.
- (2) The discharge is to a Publicly Owned Treatment Works (POTW).

- ~~A~~ (3) Any chemical additives used to treat groundwater remediation wastewater have been approved in writing by the Department and the POTW if such additives contain any substances in Appendix B, Tables II, III, and V, and Appendix D of Section 22a-430-4 of the Regulations of Connecticut State Agencies.
- ~~A~~ (4) The maximum daily flow of all discharges of groundwater remediation wastewater generated by a permittee on one site does not exceed five percent (5%) of the design capacity of the POTW which receives the discharge.
- (5) For all discharges, a completed registration form has been submitted to the Commissioner in accordance with the provisions of Section 5 of this general permit.
- ~~A~~ (6) A screening analysis has been performed in accordance with Section 4 of this general permit. The results of such analysis have been submitted to the POTW Authority on a form prescribed and provided by the Commissioner.
- ~~A~~ (7) The POTW Authority receiving the discharge has approved the discharge in writing.
- (8) The discharge of groundwater remediation wastewater within a coastal boundary as defined in Section 22a-94 of the General Statutes is consistent with all applicable goals and policies of the Coastal Management Act specified in Section 22a-92 of the General Statutes.
- (9) The discharge of groundwater remediation wastewater and installation and operation of the treatment system, piping and other equipment associated with this discharge does not threaten the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat designated as essential to such species in accordance with Section 26-310 of the General Statutes.
- (10) All required fees have been paid to the Commissioner.
- ~~A~~ (11) No categorical effluent limitation standard or guideline adopted by the U.S. Environmental Protection Agency under the federal Clean Water Act is applicable to the discharge.
- (12) Any site generating a discharge of greater than 50,000 gallons per day has in effect a valid permit issued by the Commissioner pursuant to Sections 22a-6 and 22a-378a of the General Statutes.

Any discharge of water, substance or material into the waters of the state other than as specified in this subsection, is not authorized by this general permit. Any person who or municipality which wishes to initiate, create, originate or maintain such other discharge shall first apply for and obtain an individual permit under Section 22a-430 of the General Statutes, or be authorized by a general permit issued under Section 22a-430b of the General Statutes.

(b) Geographic Area

This general permit applies throughout the State of Connecticut.

(c) *Effective Date and Expiration Date*

This general permit is effective on August 13, 1996 and shall expire on August 13, 2006.

(d) *Effective Date of Authorization*

For those persons and municipalities required to submit a registration under Section 5 of this general permit, the effective date of authorization under this general permit is the date a registration which meets the requirements of Section 5 of this general permit is received by the Commissioner.

(e) *Issuance of an Individual Permit*

If the Commissioner issues an individual permit under Section 22a-430 of the General Statutes authorizing a discharge previously authorized by this general permit, the applicability of this general permit as it applies to the individually permitted discharge is automatically terminated on the effective date of the individual permit.



Section 4. Screening Requirements

(a) *Screening Analysis*

Prior to initiating a discharge in accordance with this general permit, the water to be discharged must be tested in its raw state ("screening analysis"), in accordance with the following procedures:

- (1) For *all* discharges, raw water shall be analyzed for the following parameters:

Total Volatile Organics (EPA Methods 624 or 601 and 602 plus xylenes). In addition, the registrant shall report the 5 most prevalent tentatively identified compounds (TICs) detectable by these methodologies if such compounds are known or should reasonably be known to have been used, stored, released or disposed of on-site.

Oil and Grease-Hydrocarbon Fraction (EPA Method 413.1 as specified in Section 2 of this general permit) or Total Petroleum Hydrocarbons (EPA Method 418.1, or subsequent modification).

Methyl tertiary-butyl ether (MTBE) (as detected by EPA Method 602 or 624).

Total Lead (EPA Method 200.7, 239.1 or 239.2).

- (2) For any discharge from a site at which the person creating, originating or maintaining a discharge knows or should reasonably know that any pollutant listed in Appendix B, Tables II, III, IV and V, or Appendix D of Section 22a-430-4 of the Regulations of Connecticut's State Agencies, has been used, stored, released, or disposed of, a screening analysis for these pollutants shall be conducted.
- (3) If the person creating, originating or maintaining a discharge knows or should reasonably know that any other pollutant has been used, stored, released, or disposed of, which pollutant could be toxic, hazardous or detrimental to the operation of the sewage treatment facility, or that such pollutant may pass through the sewage treatment facility or be detrimental to sludge handling, a screening analysis shall be conducted for such pollutant.

(b) Subsequent Screening Analysis

After initiating a discharge in accordance with this general permit, the water discharged must be tested in its raw state ("screening analysis"), in accordance with the following procedures:

- (1) The screening analysis shall be conducted as specified in Section 6. (a) (1) (A) of this general permit.
- (2) The raw water shall be analyzed for:

Total Volatile Organics (EPA Methods 624 or 601 and 602 plus xylenes). In addition, the registrant shall report the 5 most prevalent tentatively identified compounds (TICs) detectable by these methodologies if such compounds are known or should reasonably be known to have been used, stored, released or disposed of on-site.

Any parameter required pursuant to section 4. (a) (2) or 4. (a) (3) of this general permit.

(c) Screening Procedures

- (1) All samples taken for the purpose of the screening analysis shall be (a) representative of the quality of water to be discharged, (b) grab samples, and (c) collected, preserved, handled and analyzed in accordance with Title 40 Part 136 of the Code of Federal Regulations (40 CFR 136).
- (2) Waters that result from well construction, well development water, and water that results from sampling programs shall be retained until the screening analysis is performed. These collected waters shall then be discharged through a treatment system if required pursuant to Section 6 of this general permit. Otherwise, such wastewaters shall be collected and disposed of off-site at an appropriate disposal facility by a licensed waste hauler.
- (3) A screening analysis shall be performed as a registration requirement and as specified in Section 6(a)(1)(A) of this general permit from the effective date of authorization and documented on a Screening Form (DEP-PERD-GRW-001) prescribed and provided by the Commissioner. The Screening Form (DEP-PERD-GRW-001) shall be submitted to the Commissioner **only (a) at the time a registration is initially submitted, or (b) if the parameters to be monitored are different than the parameters that were monitored the previous year, or (c) if screening results indicate the need to continue monitoring as specified in Section 4(c)(4) of this general permit.** Otherwise, the Screening Form (DEP-PERD-GRW-001) shall be retained on-site, or be readily accessible by the permittee, along with copies of the laboratory results, in accordance with Section 6(d) of this general permit.
- (4) Each time a screening analysis is performed, any parameter that exceeds effluent limitations listed in Attachment A of this general permit shall be identified and the water to be discharged shall be monitored thereafter for such parameters in accordance with Section 6 of this general permit. Treatment shall be required as specified in Section 6 of this general permit for any such pollutant if, (a) for any one sample the concentration exceeds three times the listed effluent limitation, or (b) compliance with limitations is not indicated in each of three consecutive sampling events following an exceedance.

Section 5. Registration Requirements

(a) Who Must Submit a Registration

Any person who or municipality which intends, in accordance with this general permit to initiate, create, originate or maintain a discharge of groundwater remediation wastewater to a POTW shall submit a completed registration form and fee. If the source or activity generating the discharge for which a registration is submitted under this general permit is owned by one person or municipality but is leased or in some other way the legal responsibility of another person or municipality (the operator), it is the operator's responsibility to submit the registration required by this general permit.

(b) Scope of Registration

A registration shall only include discharges of groundwater remediation wastewater from a single site. All discharges of groundwater remediation wastewater occurring at a particular time for a single site shall be included in the same registration.

(c) Contents of Registration

(1) Fees

- (A) A registration fee of \$250.00 shall be submitted for each new registration form or modification of an existing general permit registration. Pursuant to Section 22a-430-6(m)(1) of the Regulations of Connecticut State Agencies and Section 22a-6(b) of the General Statutes, the fee submitted by any municipalities shall be \$125.00. Pursuant to Section 22a-430-6(l) of the Regulations of Connecticut State Agencies there shall be no fee for any registration submitted for a site used solely as a single family residence.
- (B) The registration fee shall be paid by certified check or money order payable to the "Department of Environmental Protection".
- (C) The registration fee is nonrefundable.

(2) Registration Form

The registration information shall be submitted on forms prescribed and provided by the Commissioner and shall include, without limitation, the following:

- (A) Legal name, address, and telephone number of the person or municipality which wishes to initiate, create, originate or maintain the discharge and of the person who or municipality which owns the activity or source generating the discharge. If any such person(s) is a corporation transacting business in Connecticut, include the exact name as registered with the Connecticut Secretary of the State.
- (B) Legal name, address, and telephone number of the owner of the property on which the discharge is proposed to take place.
- (C) Legal name, address, and telephone number of the registrant's attorney or other representative, if any.

- (D) Legal name, address, and telephone number of any consultant retained to design the proposed remedial actions on the site.
- (E) Location address of the site for which the registration is submitted.
- (F) Identification of whether the site location is in the coastal boundary, or in an endangered species area or in a tidal wetland area or in an aquifer protection area.
- (G) An indication of whether there are any public or private drinking water wells within 1/4 mile of the site.
- (H) An indication of whether treatment will include air stripping.
- (I) Maximum daily flow and number of hours per day of the discharge.
- (J) An estimate of when the discharge will begin and the estimated duration of the discharge authorized by this general permit.
- (K) A detailed description of the type of contamination being remediated, and the likely source of such contamination.
- (L) A detailed description of the activity generating the discharge (i.e. site dewatering, pump test, groundwater recovery well).
- (M) The groundwater classification of the site, and the name, location and design flow of the POTW which will receive the discharge.
- (N) A detailed description of the type of treatment system, if any, installed to treat each discharge.
- (O) A plan of the site ("site plan") showing at least the boundaries of the site, the exact location of all existing and proposed recovery, soil venting and drinking water wells on the site, the location of discharges authorized by this general permit, the monitoring locations, the treatment system, if any, and the location of wetlands and watercourses as defined by Sections 22a-28 and 22a-38 of the General Statutes.
- (P) An 8 1/2" by 11" copy of applicable sections of a United States Geological Survey (USGS) quadrangle map, with a scale of 1:24,000, showing the exact location of each groundwater treatment system, specifying the longitude and latitude of the discharges to within the closest 15 seconds, the location of any drinking water wells within a quarter mile of the site and including the name of the USGS map.
- (Q) The results of the screening analysis performed in accordance with Section 4 of this general permit. Results shall be submitted on the Screening Form (DEP-PERD-GWR-001) prescribed and provided by the Commissioner.
- (R) For any discharge, the following certification, signed by a professional engineer, licensed to practice in Connecticut:

"I certify that in my professional judgment, proper operation and maintenance of any system installed to treat the discharges which are the subject of this registration will ensure that all effluent limitations and other conditions in the *General Permit for the*

Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer issued on August 13, 1996 will be met. This certification is based in part on my review of the information contained in the screening requirement form completed for the discharges and attached to this registration and, if applicable, a review of the historic land use of the site, and on any other water analyses associated with the discharges, and on engineering and/or hydrogeologic reports and/or plans and specifications describing (1) the proposed activities and (2) any proposed treatment facilities for the wastewater to be discharged. I am aware that there are significant penalties for false statements in this certification, including the possibility of fine and imprisonment for knowingly making false statements."

- (S) The signature of the registrant and of the individual or individuals responsible for actually preparing the registration, each of whom shall certify in writing as follows:

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that a copy of this registration has been submitted to the parties described in Section 3(a)(7) and in accordance with such section of the general permit and written approval from the receiving POTW has been received. I certify that based on reasonable investigation, including my inquiry of the individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that a false statement in the submitted information may be punishable as a criminal offense, in accordance with Section 22a-6 of the General Statutes, pursuant to Section 53a-157 of the General Statutes, and in accordance with any other applicable statute."

(d) *Where to Submit a Registration*

- (1) A registration shall be submitted to the following address:

CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

- (2) For any discharge of groundwater remediation wastewater to a POTW, a certified copy of the completed registration form including all screening documentation shall also be sent to the POTW authority which will receive the discharge.
- (3) One additional copy of the completed registration form shall be submitted along with the original at the address specified in paragraph (1) of this subsection, for each of the following conditions:
- (A) For any discharge of groundwater remediation wastewater where drinking water wells exist within one quarter mile of the proposed site;
- (B) For any discharge of groundwater remediation wastewater where air stripping is used as a wastewater treatment.

(e) Correction of Inaccuracies

Within fifteen days after the date the registrant or permittee becomes aware of a change in any information in registration documents submitted to the Commissioner under this general permit, or that any such information was inaccurate or misleading or that any relevant information was omitted, such registrant or permittee shall submit the correct or omitted information in writing on forms prescribed and provided by the Commissioner.

(f) False Statements

Any false statement in any information submitted pursuant to this general permit may be punishable as a criminal offense under Section 22a-438 of the General Statutes or, in accordance with Section 22a-6, under Section 53a-157 of the General Statutes.

(g) Additional Information

The Commissioner may require a registrant to submit additional information which the Commissioner deems necessary to evaluate the consistency of the discharges of groundwater remediation wastewater with the criteria for authorization under this general permit.

(h) Disapproval and Rejection of a Registration

- (1) The Commissioner may disapprove a registration (a) for the same reasons for which he may, under Section 22a-430 of the General Statutes, require an individual permit, including without limitation, if he finds that the groundwater remediation activity is inconsistent with the criteria for authorization under this general permit, (b) if he finds that the groundwater remediation activity is inconsistent with any of the applicable standards and criteria of Sections 22a-365 to 22a-378 of the General Statutes, inclusive, Section 22a-430 and Section 22a-32 of the General Statutes, or (c) for any other reason provided by law. Disapproval of a registration under this subdivision shall constitute notice that an individual permit must be obtained under Section 22a-430 of the General Statutes.
- (2) The Commissioner may reject a registration if he determines that (a) said registration is insufficient, or (b) more than thirty (30) days have elapsed since the Commissioner requested that the registrant submit additional information or the required registration fee and the registrant has not submitted such information or fee. A registration resubmitted after rejection pursuant to this subdivision shall be accompanied by the registration fee required under Section 5(c)(1) of this general permit.

(i) Transfer of Authorization

Any authorization under this general permit shall be non-transferable.

Section 6. Permit Terms and Conditions

(a) Monitoring and Treatment Requirements

- (1) All discharges shall be monitored and treated in accordance with the following:
 - (A) For all discharges with a maximum daily flow exceeding 5,000 gallons per day, the permittee shall, on a semiannual basis, perform a screening analysis as outlined in Section 4 of this general permit. For discharges with a maximum daily flow less than 5,000 gallons per day, the permittee shall, on an annual basis, perform a screening analysis as outlined in Section 4 of this general permit.

- (B) The permittee shall monitor the discharges for the presence of Volatile Organic Compounds (VOCs) using EPA Method 624, 601 and 602 plus xylenes, or the equivalent. To determine treatment requirements for VOCs, the permittee shall add the individual concentrations of all compounds detected in any single sample analyzed using these methods. If the sum of those compounds reported under EPA Method 601 exceeds 1.0 mg/l, or the total of all VOCs exceeds 5.0 mg/l, the permittee shall treat the discharges for the removal of VOCs using either:
- (i) An air stripping system utilizing an air stripping tower equipped with an electrically operated automatic shut-off which disconnects power to the well pump whenever the air blower is not operating; or
 - (ii) A treatment system using activated carbon filtration designed to consistently treat the groundwater to below 1.0 mg/l total VOCs as described above.
- (C) ~~The permittee shall monitor and treat the discharges for oil and grease if:~~ (1) the results of any analysis of the discharges indicates that oil and grease is present in the groundwater above 100 mg/l; or (2) oil or an oily sheen is visible in the water to be discharged; or (3) the source of the contamination being remediated is petroleum oil. EPA Method 413.1 or 418.1 shall be used for the analysis of oil and grease - hydrocarbon fraction or Total Petroleum Hydrocarbon (TPH). The discharger shall treat the discharges for the removal of oil using either:
- (i) Gravity separation (including lamella plate systems);
 - (ii) Oil absorbents;
 - (iii) Ultrafiltration or other comparable filtration technology, or
 - (iv) Any combination of the above technologies necessary to maintain oil and grease concentrations below 100 mg/l in the discharges at all times.
- (D) The permittee shall monitor the discharges for total lead: if (1) any analysis indicates that lead is present in the groundwater at concentrations greater than 0.1 mg/l; or (2) the site has been historically or presently used as a vehicle service operation; or (3) the source of the contamination being remediated is gasoline. For any site where lead concentrations in the discharges exceeds 0.1 mg/l, the permittee shall treat the discharges for removal of lead to below 0.1 mg/l.
- (E) The permittee shall monitor and treat the discharges for any other pollutant in accordance with this section, if the screening analysis performed in accordance with Section 4(b) of this general permit identifies the presence of any pollutant in the groundwater at levels above either: (a) any effluent limitations listed in the municipal sewer ordinance of the receiving POTW; or (b) the limitations listed in Attachment A of this general permit. Treatment of the discharges for removal of any such pollutant to a level below the effluent limitation listed in Attachment A of this general permit shall be performed prior to discharge.

(2) Monitoring Location

- (A) Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at a monitoring point before the effluent joins or is diluted by any other wastestream, or substance.

(B) For any site with more than one discharge point to the sanitary sewer, individual samples shall be collected from each discharge. Samples shall be designated as DSN 201, DSN 202, etc.

(3) Monitoring to verify compliance with the effluent limitations in this section and Attachment A of this general permit shall be performed according to the following schedule:

(A) For each initiation or restart of a discharge after an exceedance of an effluent limitation, the discharge shall be sampled on the first day of discharge and then every other day for the first two weeks, weekly for the next month, and then as follows depending upon the maximum daily flow:

<i>Maximum Daily Flow</i> <i>(gallons per day)</i>	<i>Monitoring Frequency</i>
Less than 5,000	quarterly
5,000 or more	monthly

(B) For each restart of a discharge for any reason other than an exceedance of a parameter limit, the discharge shall be sampled on the first day of discharge and then in accordance with the sampling schedule at the time the discharge was ceased.

(C) For intermittent discharges, of groundwater remediation wastewaters, generated from scheduled activities conducted at sites that have no other discharges of such wastewaters, the following monitoring shall be required;

A minimum of one representative sample shall be collected per discharge event and analyzed in accordance with section 6.(a)(4) of this general permit.

If multiple points are sampled independently, a volume proportioned average of analytical results may be substituted for a single sample

Treatment and discharge shall be conducted as described for screening waters in section 4.(c)(2) of this general permit.

(4) Samples taken for purposes of determining compliance with all effluent limitations and monitoring requirements listed in this general permit shall be grab samples. All sample analyses which are required by this general permit and all reporting of such analyses, shall be done by a laboratory certified by the Connecticut Department of Public Health. Chemical analysis shall be performed using methods approved in accordance with 40 CFR 136 which are capable of achieving limits of detection below the level established as an effluent limitation in Section 5(d) and Attachment A of this general permit.

(5) All discharges of greater than 5000 gallons per day, shall have a flow meter installed capable of recording total daily flow. Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated, and maintained to ensure that the accuracy of the measurements is consistent with the accepted capability of that type of device. All other discharges shall implement flow measuring procedures to adequately estimate flows.

- (6) The permittee shall periodically calibrate and perform maintenance on all monitoring and field equipment used to monitor the pollutants discharged under this general permit, at intervals that will ensure the accuracy of measurements.

(b) Effluent Limitations

- (1) The effluent limitations specified in Attachment A shall not be exceeded at any time as determined by a grab sample.
- (2) The pH of the discharges shall not be less than 5.0 nor greater than 10.0 standard units at any time.

(c) Pollution Prevention/Best Management Practices

- (1) Solid waste, including but not limited to contaminated soils or sludges, may be generated as a result of the remediation activity allowed by this general permit. All waste generated must be disposed of in accordance with applicable federal, state and local law. Some or all of these wastes may be hazardous waste identified in accordance with Section 3001 of the Federal Resource Conservation and Recovery Act of 1976 (42 USC 6901 et seq.) or other wastes of special concern requiring Department approval prior to disposal. It is the responsibility of the permittee to ensure that all wastes generated are properly identified and that all necessary Department approvals are secured prior to disposal of the wastes. For further information regarding solid waste management, please contact the Waste Engineering and Enforcement Division of the Department of Environmental Protection at (860) 424-3023.
- (2) Erosion and sediment controls shall be utilized at the site when necessary to prevent discoloration or sedimentation of surface waters as the result of any activity at the site associated with this general permit. Erosion and sedimentation controls may consist of the diversion of run-on, use of hay bales, silt fence, filtration or settling, and must comply at a minimum, with the standards set forth in the "Connecticut Guidelines for Soil Erosion and Sediment Control" as amended, which is available at the Department's Maps and Publication Sales Office at (860) 424-3555.
- (3) Air pollution, including but not limited to hazardous air pollutants, may be emitted as a result of the remediation activity allowed by this general permit. It is the responsibility of the permittee to ensure that all air pollution emitted is properly identified and quantified, and that all necessary Department approvals are secured prior to emitting such pollutants. All air pollution emitted must be analyzed to ensure compliance with all applicable federal, state and local laws including but not limited to Sections 22a-174-1 (Definitions), 22a-174-3 (New Sources), and 22a-174-29 (Hazardous Air Pollutants) of the Regulations of Connecticut State Agencies and the National Emission Standards for Hazardous Air Pollutants (NESHAPs) in the Code of Federal Regulations (40 CFR Part 61). For further information, please contact the New Source Review Group, DEP, Bureau of Air Management at (860) 424-3028.
- (4) No litter, debris, building materials, or similar materials shall be discharged to the waters of the state from the site.
- (5) The permittee shall conduct routine inspections of all equipment associated with the discharges authorized by this general permit. Inspections shall be conducted as necessary to insure proper operation of all equipment, but at intervals of no more than 7 days, unless

the site is a remote site as defined in Section 2 of this general permit with a maximum daily flow of under 14,400 gallons per day. Remote sites with maximum daily flows of less than 14,400 gallons per day shall be inspected as necessary to insure proper operation of all equipment, but at intervals of no more than 30 days.

A log shall be maintained on-site documenting the date of inspection, inspector's name, verification of operation of critical equipment, and a summary of any work or change in equipment associated with the discharges authorized by this general permit.

(d) Reporting and Record Keeping Requirements

- (1) Except as provided below, or as otherwise specified by the Commissioner, all analytical results from monitoring and other information required under this general permit shall not be required to be submitted to the Commissioner but instead shall be retained on-site, or be readily available by the permittee as required by Section 22a-430-3(j)(9)(B) of the Regulations of Connecticut State Agencies on a Discharge Monitoring Report Form (DEP-PERD-GRW-002) prescribed and provided by the Commissioner. Copies of all such forms shall be submitted to the receiving POTW if requested by an official of the POTW.
- (2) The permittee shall immediately cease the discharge and immediately notify the receiving POTW and the Department by phone as soon as it knows or has reason to believe that the remediation discharge could be reasonably expected to cause adverse effects on the POTW operation. The permittee shall, within 7 days of becoming aware of such occurrence, submit written notification to the Department and to the POTW Authority if requested by the Authority.

Notification by phone shall be made to the Engineer of the Day at (860) 424-3018.

Written notification shall be directed to:

COMPLIANCE SECTION
WATER MANAGEMENT BUREAU/PERD
DEPARTMENT OF ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

(e) Recording and Reporting Violations

- (1) If any analytical results or monitoring data collected under this general permit indicate that a violation of an effluent limitation or another condition of this general permit has occurred, the permittee shall immediately take all measures necessary to ensure that the discharge will comply with effluent limitations and conditions specified in this general permit. All violations shall be recorded on a Violation Form (DEP-PERD-GRW-003) prescribed and provided by the Commissioner. Such form shall, within twenty-four hours of knowledge of the violation, be completed and placed in a log which is maintained at the site, or is readily accessible by the permittee.

- (2) A copy of each Violation Form (DEP-PERD-GRW-003) shall be submitted to the Commissioner at the following address, within one week of the violation:

DMR SECTION
WATER MANAGEMENT BUREAU/PERD
DEPARTMENT OF ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

- (3) Immediately after the third simultaneous or consecutive, or fourth annual violation, as applicable, the discharge shall be stopped and shall not be resumed until the permittee submits a report prepared by a professional engineer licensed to practice in Connecticut. Such report shall describe actions which have been taken to prevent further violations of this general permit. The report shall contain the following certification signed by a professional engineer licensed to practice in Connecticut:

"I certify that in my professional judgment that appropriate modifications and/or additions have been made to the system designed to treat the discharges of groundwater remediation wastewater at the site, and that all discharges of groundwater remediation wastewater at the site comply with all conditions of said permit, including but not limited to all effluent limitations in Sections 6(a) and 6(b) and Attachment A of the *General Permit for the Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer*, and proper operation and maintenance of any system installed to treat such discharges will insure that all effluent limitations and other conditions in such general permit are met, or if there is no treatment system for such discharges, that appropriate modifications have been made to the operations at the site and the discharges will meet all effluent limitations and conditions of such general permit without treatment. I am aware that there are significant penalties for false statements in this certification, including the possibility of fine and imprisonment for knowingly making false statements."

- (4) A copy of any report required to be submitted under this section, shall also be sent to the POTW which receives the discharges.

Section 7. General Conditions

(a) Regulations of Connecticut State Agencies Incorporated into this General Permit

The permittee shall comply with the following Regulations of Connecticut State Agencies which are hereby incorporated into this general permit, as if fully set forth herein:

- (1) Section 22a-430-3:

Subsection (b) General - subparagraph (1)(D) and subdivisions (2), (3), (4) and (5)

Subsection (c) Inspection and Entry.

Subsection (d) Effect of a Permit - subdivisions (1) and (4)

Subsection (e) Duty to Comply

Subsection (f) Proper Operation and Maintenance

Subsection (g) Sludge Disposal

Subsection (h) Duty to Mitigate

Subsection (i) Facility Modifications, Notification - subdivisions (1) and (4)

Subsection (j) Monitoring, Records and Reporting Requirements -

subdivisions (1), (6), (7), (8), (9) and (11) (except subparagraphs (9)(A)(2), and (9)(C))

Subsection (k) Bypass

Subsection (m) Effluent Limitation Violations
Subsection (n) Enforcement
Subsection (o) Resource Conservation
Subsection (p) Spill Prevention and Control
Subsection (q) Instrumentation, Alarms, Flow Recorders
Subsection (r) Equalization

(2) Section 22a-430-4:

Subsection (t) - Prohibitions
Subsection (p) - Revocation, Denial, Modification
Appendices

(b) Additional Terms and Conditions

The permittee shall comply with the following additional terms and conditions:

- (1) The permittee is authorized to discharge (a) pollutants in quantities and concentrations as specified in this general permit and (b) any substances resulting from the activities described in this general permit in concentrations and quantities which the Commissioner determines cannot reasonably be expected to cause pollution and will not adversely affect surface waters, groundwaters, or the operation of a POTW. The Commissioner may seek an injunction or issue an order to prevent or abate pollution, and may seek criminal penalties against a permittee who willfully or with criminal negligence causes or threatens pollution.
- (2) Discharge of any substance which is not from the activities described in this general permit shall be considered a violation of this general permit unless it is authorized by an individual permit issued under Section 22a-430 of the General Statutes, or another general permit issued under Section 22a-430b of the General Statutes.
- (3) The permittee shall at all times continue to comply with the conditions for authorization set forth in Section 3 of this general permit.
- (4) Nothing in this general permit shall relieve the registrant or permittee of other obligations under applicable federal, state and local law.
- (5) Any document, including but not limited to any notice, which is required to be submitted to the Commissioner under this general permit by the registrant/permittee shall be signed by the registrant/permittee and by the individual or individuals responsible for actually preparing such document, each of whom shall certify in writing as follows:

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that a false statement made in the submitted information may be punishable as a criminal offense, in accordance with Section 22a-6 of the General Statutes, pursuant to Section 53a-157b of the General Statutes, and in accordance with any other applicable statute."
- (6) The Commissioner reserves the right to make appropriate revisions to this general permit in order to establish any appropriate effluent limitations, schedules of compliance, or

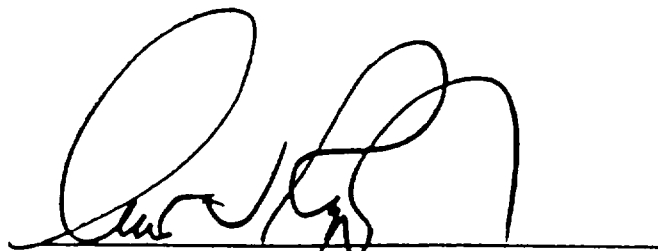
other provisions which may be necessary to adequately protect human health and the environment.

- (7) The Commissioner may order summary suspension of this general permit in accordance with Section 4-182 of the General Statutes.

Section 8. Unauthorized Activities

Any person who or municipality which fails to submit a registration, and that initiates, creates, originates or maintains a discharge of groundwater remediation wastewater into the waters of the state without authorization by this general permit, except those authorized by an individual permit issued under Section 22a-430 of the General Statutes, or an authorization issued pursuant to Section 22a-6k, of the General Statutes is in violation of the General Statutes, and is subject to injunction and penalties under Chapter 446k of the General Statutes.

Issued: August 13, 1996



Sidney J. Holbrook
Commissioner

Base Neutral and Acid Extractables (BNA): EPA Method 625

BNA's (Excludes Phenol and PAHs)	Maximum Concentration
<p align="center">Combined Total of All BNAs Excluding Phenols and PAHs Shall Not Exceed 2.0 mg/l</p>	

Phenols: EPA Method 625

Phenol	Maximum Concentration
2-sec-Butyl-4,6-dinitrophenol (DNBP)	<p align="center">Combined Total of All Phenols Shall Not Exceed 1.0 mg/l</p>
4-Chloro-3-methylphenol	
2-Chlorophenol	
Cresols(methyl phenols)	
2-Cyclohexyl-4,6-dinitrophenol	
2,4-Dichlorophenol	
2,6-Dichlorophenol	
2,4-Dimethylphenol	
2,4-Dinitrophenol	
2-Methyl-4,6-dinitrophenol	
2-Nitrophenol	
4-Nitrophenol	
Pentachlorophenol	
Phenol	
Tetrachlorophenols	
Trichlorophenols	
2,4,6-Trichlorophenol	

Attachment A: Toxic and Hazardous Pollutants and Their Maximum Concentrations

Volatile Organic Compounds: EPA Methods 601 & 602 plus Xylenes or 624

Combined Total of All Individual Compounds Detectable by EPA Method 601 Shall Not Exceed 1.0 mg/l
Combined Total of All Individual Compounds Detectable by EPA Methods 601 & 602 plus Xylenes or EPA Method 624 Shall Not Exceed 5.0 mg/l
MTBE as Detectable by EPA Method 602 Shall Not Exceed 1.0 mg/l

Oil & Grease - Hydrocarbon Fraction: EPA Method 413.1 (Per Section 2 of This General Permit) or Total Petroleum Hydrocarbons by EPA Method 418.1

The Total Oil & Grease - Hydrocarbon Fraction or Total Petroleum Hydrocarbons Shall Not Exceed 100 mg/l
--

EPA Method 200.7 or other methods approved in accordance with 40 CFR section 136 which are capable of achieving limits of detection below the levels established below

Metals	Maximum Concentration
Arsenic	0.1 mg/l
Barium	5.0 mg/l
Beryllium	2.0 mg/l
Boron	5.0 mg/l
Cadmium	0.1 mg/l
Chromium	1.0 mg/l
Hexavalent Chromium	0.1 mg/l
Cobalt	2.0 mg/l
Copper	1.0 mg/l
Lead	0.1 mg/l

Metals	Maximum Concentration
Magnesium	50 mg/l
Mercury	0.005 mg/l
Nickel	1.0 mg/l
Selenium	1.0 mg/l
Silver	0.1 mg/l
Thallium	1.0 mg/l
Tin	2.0 mg/l
Vanadium	1.0 mg/l
Zinc	1.0 mg/l

Polynuclear Aromatic Hydrocarbons (PAHs): EPA Method 610

PAH	Maximum Concentration
Acenaphthene	<p>Combined Total of All PAHs</p> <p>Shall Not Exceed 0.5 mg/l</p>
Acenaphthylene	
Anthracene	
Benzo(a)anthracene	
Benzo(a)phrene	
Benzo(b)fluoranthene	
Benzo(j)fluoranthene	
Benzo(k)fluoranthene	
Benzo(ghi)perylene	
Chrysene	
Dibenz(a,h)acridine	
Dibenz(a,j)acridine	
Dibenzo(a,h)anthracene	
H-Dibenzo(c,g)carbazole	
Dibenzo(a,e)pyrene	
Dibenzo(a,h)pyrene	
Dibenzo(a,i)pyrene	
Fluoranthene	
Fluorene	
Indeno(1,2,3-cd)pyrene	
3-Methylcholanthrene	
Naphthalene	
Phenanthrene	
Pyrene	

Organochlorine Pesticides: EPA Method 608

Pesticide	Maximum Concentration (µg/l)
Aldrin	1.5 µg/l
Alpha-BHC	1.0 µg/l
Beta-BHC	1.0 µg/l
Delta-BHC	1.0 µg/l
Gamma-BHC (Lindane)	2.0 µg/l
Chlordane (technical)	20 µg/l
4,4'-DDD	0.2 µg/l
4,4'-DDE	0.2 µg/l
4,4'-DDT	0.2 µg/l
Dieldrin	10 µg/l
Endosulfan I	2.0 µg/l
Endosulfan II	2.0 µg/l
Endosulfan sulfate	2.0 µg/l
Endrin	1.0 µg/l
Endrin aldehyde	1.0 µg/l
Heptachlor	0.6 µg/l
Heptachlor epoxide	0.4 µg/l
Methoxychlor	360 µg/l
Toxaphene	10 µg/l

Phthalate Esters: EPA Method 606

Phthalate Ester	Maximum Concentration
Benzyl butyl phthalate	<p>Combined Total of All Phthalates</p> <p>Shall Not Exceed 2.0 mg/l</p>
Bis(2-ethylhexyl)phthalate	
Di-n-butyl phthalate	
Diethyl phthalate	
Dimethyl phthalate	
Di-n-octyl phthalate	

PCBs: EPA Method 608

PCB	Maximum Concentration
PCB-1016	<p>Combined Total of All PCBs</p> <p>Shall Not Exceed 1.0 $\mu\text{g/l}$</p>
PCB-1221	
PCB-1232	
PCB-1242	
PCB-1248	
PCB-1254	
PCB-1260	
OTHER PCB's	

If other PCBs have been used or stored on-site or there is reason to believe they may be present, each compound must be analyzed for in addition to the seven listed PCBs.

Chlorinated Herbicides: EPA Method 615

Herbicide	Maximum Concentration
2,4,-D	<p>Combined Total of 2,4-D plus 2,4-DB Shall Not Exceed 700 $\mu\text{g/l}$</p>
2,4-DB	
2,4,5-T	10.0 $\mu\text{g/l}$
2,4,5-TP (Silvex)	10.0 $\mu\text{g/l}$
Dicamba	10.0 $\mu\text{g/l}$

Cyanide: EPA Method 335.1 ; 335.2

Cyanide	Maximum Concentration
Total Cyanide	0.6 mg/l
Amenable Cyanide	0.1 mg/l



General Permit Registration Form for the Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer

Please complete this form in accordance with the general permit (DEP-PERD-GP-007) in order to ensure the proper handling of your registration. Print or type unless otherwise noted. You must submit the *Permit Application Transmittal Form* (DEP-APP-001) and the registration fee along with this form.

DEP USE ONLY

Application No. _____

Permit No. _____

Facility I.D. _____

Part I: Registration Type

This registration is for (check one):

- ☐ A *new* general permit
- ☐ A *replacement* of an individual State or NPDES permit, or an authorization
- ☐ A *renewal* of an existing general permit
- ☐ A *modification* of an existing general permit

1. Existing permit or authorization number: _____

2. Facility ID number (fka DEP/WPC number): _____

3. Expiration Date: _____

Note: The registration fee of \$250.00 for any person and \$125.00 for any municipality shall be submitted with a completed registration form. A registration shall not be deemed complete and no activity shall be authorized by this general permit unless the registration fee has been paid in full.

The fee shall be non-refundable and shall be paid by certified check or money order payable to the Department of Environmental Protection. The check shall state, "Water Management Fee".

Part II: Registrant Information

1. Fill in the name of the applicant/registrant/operator as indicated on the *Permit Application Transmittal Form* (DEP-APP-001).

Applicant/Registrant/Operator: Loureiro Engineering Associates

Mailing Address: 100 Northwest Drive

City/Town: Plainville State: CT Zip Code: 06062

Business Phone: (861) 747-6181 ext. _____ Fax: (861) 747-8822

Contact Person: George E. Andrews Title: _____

Part II: Registrant Information (continued)

2. List facility or site owner.

Name: _____

Mailing Address: _____

City/Town: _____ State: _____ Zip Code: _____

Business Phone: (____) _____ ext. _____ Fax: (____) _____

Contact Person: _____ Title: _____

3. List primary contact for departmental correspondence and inquiries (if other than applicant).

Name: _____

Mailing Address: _____

City/Town: _____ State: _____ Zip Code: _____

Business Phone: (____) _____ ext. _____ Fax: (____) _____

Contact Person: _____ Title: _____

4. List attorney or other representative, if applicable.

Firm Name: _____

Mailing Address: _____

City/Town: _____ State: _____ Zip Code: _____

Business Phone: (____) _____ ext. _____ Fax: (____) _____

Contact Person: _____ Title: _____

5. List any other engineer(s) or consultant(s) employed or retained to assist in preparing the registration or in designing, constructing or operating the groundwater remediation wastewater activity.

Please enter a check mark if additional sheets are attached. ☐

Name: _____

Mailing Address: _____

City/Town: _____ State: _____ Zip Code: _____

Business Phone: (____) _____ ext. _____ Fax: (____) _____

Contact Person: _____ Title: _____

Service Provided: _____

Part III: Site Information

1. Name of facility, if applicable: _____
Street Address or Description of Location: _____

City or Town: _____
2. Is the project site located in a town within a coastal area as defined in section 22a-94(a) CGS?
☐ Yes ☐ No If yes, you must submit a coastal consistency worksheet with your registration.
3. Is the project site located within an endangered, threatened or special concern species area as identified on the "State and Federal Listed Species and Natural Communities Map"? (map available at DEP, 79 Elm St., store level) ☐ Yes ☐ No Date of Map: _____

Has a field survey been conducted to identify any presence or absence of endangered, threatened or special concern species? ☐ Yes ☐ No If yes, provide:
Biologist's Name: _____
Company Name: _____
and submit a copy of the field survey with your application.
4. Is the site located within an aquifer protection area as defined in CGS 22a-354a? ☐ Yes ☐ No

Part IV: Activity Information

1. Maximum Daily Flow of the withdrawal and discharge _____ gpd
Number of hours per day of the withdrawal and discharge _____
2. Estimated duration of the withdrawal and discharge activity. Provide an estimated beginning and ending date.

3. A detailed description of the type of contamination being remediated and the likely source of such contamination.

Part IV: Activity Information (continued)

4.	A detailed description of the activity generating the withdrawal and the discharge.
<hr/> <hr/>	
5.	a. Groundwater classification of the site _____
	b. Name and location of POTW _____
	Design Flow of POTW _____
6.	A detailed description of the type of treatment system installed to treat the discharge.
<hr/> <hr/> <hr/>	
7.	A brief description of the BMP's to be implemented by the permittee to minimize the adverse environmental affects of activities covered under this general permit.
<hr/> <hr/> <hr/>	

Part V: Supporting Documents

The supporting documents outlined below must be submitted with the registration form.

1.	Plan of the site showing at least the boundaries of the site, the exact location of all existing and proposed recovery, soil venting and drinking water wells on the site, the location of discharges covered under this general permit, the monitoring locations, the treatment systems and the location of wetlands and watercourses as defined by Sections 22a-28 and 22a-38 of the General Statutes.
2.	An 8 ½" by 11" copy of a United States Geological Survey (USGS) quadrangle map, with a scale of 1:24,000, showing the exact location of each discharge, specifying the longitude and latitude of the discharge to within the closest 15 seconds, the location of any drinking water wells within a quarter mile of the site. Please include the quadrangle name and number of the USGS map.
3.	The attached Professional Engineer Certification (DEP-PERD-REG-001A)
4.	The attached screening form (DEP-PERD-REG-001B)

Part VI: Certification

The registrant *and* the individual(s) responsible for actually preparing the registration must sign this part. A registration will be considered incomplete unless all signatures asked for are provided.

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that a copy of this registration has been submitted to the parties described in Section 3(a)(7) and in accordance with such section of the general permit and written approval from the receiving POTW has been received. I certify that based on reasonable investigation, including my inquiry of the individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that a false statement in the submitted information may be punishable as a criminal offense, in accordance with Section 22a-6 of the General Statutes, pursuant to Section 53a-157 of the General Statutes, and in accordance with any other applicable statute."

Signature of Registrant

Date

Name of Registrant (print or type)

Title (if applicable)

Signature of Preparer

Date

Name of Preparer (print or type)

Title (if applicable)

☐ Please enter a check mark if additional signatures are necessary. If so, please reproduce this sheet and attach signed copies to this sheet.

Note: Please submit the *Permit Application Transmittal Form*, the Registration Form, Fee, and all Supporting Documents to:

CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

Part VII: Registration Mailing List

List the names of the agencies to which the registration was submitted and the date of submittal. *

The following have received copies of this registration and supporting documents:

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Name: _____ Date: _____

Professional Engineer Certification

The following certification must be signed by an independent professional engineer, not in the regular employ of the permittee, licensed to practice in Connecticut. For short term discharges of one month or less, the following certification by an independent professional engineer is not required.

"I certify that in my professional judgement, proper operation and maintenance of any systems installed to treat the discharge(s) which are the subject of this registration will ensure that all effluent limitations and other conditions in the General Permit for the Withdrawal and Discharge of Ground Water Remediation Wastewater issued on August 13, 1996 are met, [or if there is no treatment system for such discharge(s), that the discharge(s) will meet all effluent limitations and conditions of such general permit without treatment]. This certification is based in part on my review of the information contained in the screening requirement form completed for this discharge and attached to this registration and if applicable a review of the historic land use of the site, and on any other water analyses associated with this discharge, and on engineering and/or hydrogeologic reports and/or plans and specifications describing (1) the proposed activities and (2) any proposed treatment facilities for the wastewaters to be discharged. I am aware that there are significant penalties for false statements in this certification, including the possibility of fine and imprisonment for knowingly making false statements."

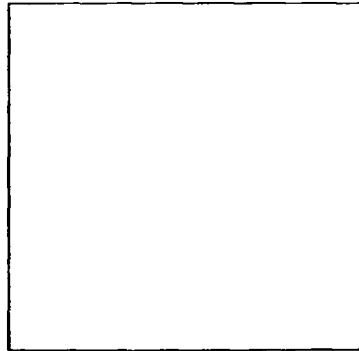
Signature of Professional Engineer

Date

Name of Professional Engineer (print or type)

P.E. Number

Affix P.E. Stamp Here



General Permit for the Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer Screening Form

Site Name: _____

Address: _____

(Information supplied by DEP)

Application No. _____

General Permit No. _____

Facility I.D. _____

"I certify that I have personally examined and am familiar with the information submitted in this document, and I certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the information is true, accurate and complete to the best of my knowledge and belief. I understand that a false statement made in this information may be punishable as a criminal offense, in accordance with Section 22a-6 of the General Statutes, pursuant to Section 53a-157 of the General Statutes, and in accordance with any other applicable statute."

Signature - Title

Date

Monitoring results shall be recorded below and on the following pages as required in Sections 4 and 6 of this general permit. Parameters not required shall be marked "NA".

Date Sampled: _____

DSN: _____

Parameter	Result	Limit
Daily Flow		
VOCs as detected by EPA Method 601		1.0 mg/l
Total VOCs (EPA Method 601 & 602)		5.0 mg/l
Oil & Grease - Hydrocarbon Fraction		100 mg/l
MTBE		1.0 mg/l
Total Lead		0.1 mg/l
Arsenic		0.1 mg/l
Barium		5.0 mg/l
Beryllium		2.0 mg/l
Boron		5.0 mg/l
Cadmium		0.1 mg/l
Chromium (total)		1.0 mg/l
Chromium (hexavalent)		0.1 mg/l
Cobalt		2.0 mg/l
Copper		1.0 mg/l
Magnesium		50 mg/l
Mercury		0.005 mg/l
Nickel		1.0 mg/l
Selenium		1.0 mg/l
Silver		0.1 mg/l
Thallium		1.0 mg/l
Tin		2.0 mg/l

Parameter	Result	Limit	
Vanadium		1.0 mg/l	
Zinc		1.0 mg/l	
Total Cyanide		0.6 mg/l	
Amenable Cyanide		0.1 mg/l	
Phenols (EPA Method 625)		1.0 mg/l	
Pthalate Esters (EPA Method 606)		2.0 mg/l	
Polynuclear Aromatic Hydrocarbons (PAHs) (EPA Method)		0.5 mg/l	
Base Neutral/Acid Extractables (BNAs) (EPA Method 625, Excluding PAHs & Phenols)		1.0 mg/l	
Pesticides (EPA Method 608)			
Aldrin		1.5 ug/l	
alpha-BHC		1.0 ug/l	
beta-BHC		1.0 ug/l	
delta-BHC		1.0 ug/l	
gamma-BHC (Lindane)		2.0 ug/l	
Chlordane (technical)		20 ug/l	
4,4' - DDD, plus 4,4' - DDE, plus 4,4' - DDT Combined		0.2 ug/l	
Dieldrin		10 ug/l	
Endosulfan I		2.0 ug/l	
Endosulfan II		2.0 ug/l	
Endosulfan Sulfate		2.0 ug/l	
Endrin		1.0 ug/l	
Endrin aldehyde		1.0 ug/l	
Heptachlor		0.6 ug/l	
Heptachlor epoxide		0.4 ug/l	
Methoxychlor		360 ug/l	
Toxaphene		10 ug/l	
Chlorinated Herbicides (EPA Method 615)			
2,4 D plus 2,4 DB		700 ug/l	
2,4,5 T		10 ug/l	
2,4,5 TP (Silvex)		10 ug/l	
Dicamba		10 ug/l	
PCBs (EPA Method 608)			
Sum of all detected PCBs shall not exceed 1.0 ug/l.			
Parameter	Result	Parameter	Result
PCB - 1016		Other PCBs if present:	
PCB - 1221			
PCB - 1232			
PCB - 1242			
PCB - 1248			
PCB - 1254			
PCB - 1260		Total PCBs:	

Submit to: DMR SECTION* *Except for monitoring submitted as part of the General Permit registration process.
WATER MANAGEMENT BUREAU/PERD
DEPARTMENT OF ENVIRONMENTAL PROTECTION
79 ELM STREET, HARTFORD, CT 06106-5127

General Permit for the Discharge of Groundwater Remediation Wastewater to a Sanitary Sewer *Discharge Monitoring Report Form*

Site Name: _____

Address: _____

(Information supplied by DEP)

Application No. _____

General Permit No. _____

Facility I.D. _____

"I certify that I have personally examined and am familiar with the information submitted in this document, and I certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the information is true, accurate and complete to the best of my knowledge and belief. I understand that a false statement made in this information may be punishable as a criminal offense, in accordance with Section 22a-6 of the General Statutes, pursuant to Section 53a-157 of the General Statutes, and in accordance with any other applicable statute."

Signature - Title

Date

Monitoring results shall be recorded below and on the following pages as required in Sections 4 and 6 of this general permit. Parameters not required shall be marked "NA".

Date Sampled: _____

DSN: _____

Parameter	Result	Limit
Daily Flow		
VOCs as detected by EPA Method 601		1.0 mg/l
Total VOCs (EPA Method 601 & 602)		5.0 mg/l
Oil & Grease - Hydrocarbon Fraction		100 mg/l
MTBE		1.0 mg/l
Total Lead		0.1 mg/l
Arsenic		0.1 mg/l
Barium		5.0 mg/l
Beryllium		2.0 mg/l
Boron		5.0 mg/l
Cadmium		0.1 mg/l
Chromium (total)		1.0 mg/l
Chromium (hexavalent)		0.1 mg/l
Cobalt		2.0 mg/l
Copper		1.0 mg/l
Magnesium		50 mg/l
Mercury		0.005 mg/l
Nickel		1.0 mg/l
Selenium		1.0 mg/l
Silver		0.1 mg/l
Thallium		1.0 mg/l
Tin		2.0 mg/l

Parameter	Result	Limit	
Vanadium		1.0 mg/l	
Zinc		1.0 mg/l	
Total Cyanide		0.6 mg/l	
Amenable Cyanide		0.1 mg/l	
Phenols (EPA Method 625)		1.0 mg/l	
Pthalate Esters (EPA Method 606)		2.0 mg/l	
Polynuclear Aromatic Hydrocarbons (PAHs) (EPA Method)		0.5 mg/l	
Base Neutral/Acid Extractables (BNAs) (EPA Method 625, Excluding PAHs & Phenols)		1.0 mg/l	
Pesticides (EPA Method 608)			
Aldrin		1.5 ug/l	
alpha-BHC		1.0 ug/l	
beta-BHC		1.0 ug/l	
delta-BHC		1.0 ug/l	
gamma-BHC (Lindane)		2.0 ug/l	
Chlordane (technical)		20 ug/l	
4,4' - DDD, plus 4,4' - DDE, plus 4,4' - DDT Combined		0.2 ug/l	
Dieldrin		10 ug/l	
Endosulfan I		2.0 ug/l	
Endosulfan II		2.0 ug/l	
Endosulfan Sulfate		2.0 ug/l	
Endrin		1.0 ug/l	
Endrin aldehyde		1.0 ug/l	
Heptachlor		0.6 ug/l	
Heptachlor epoxide		0.4 ug/l	
Methoxychlor		360 ug/l	
Toxaphene		10 ug/l	
Chlorinated Herbicides (EPA Method 615)			
2,4 D plus 2,4 DB		700 ug/l	
2,4,5 T		10 ug/l	
2,4,5 TP (Silvex)		10 ug/l	
Dicamba		10 ug/l	
PCBs (EPA Method 608)			
Sum of all detected PCBs shall not exceed 1.0 ug/l.			
Parameter	Result	Parameter	Result
PCB - 1016		Other PCBs if present:	
PCB - 1221			
PCB - 1232			
PCB - 1242			
PCB - 1248			
PCB - 1254			
PCB - 1260		Total PCBs:	

Results to be maintained on site, or be readily accessible by the permittee.

**General Permit for the Discharge of
Groundwater Remediation Wastewater to a Sanitary Sewer
Violation Form**

Site Name: _____

Address: _____

(Information supplied by DEP)

Application No. _____

General Permit No. _____

Facility I.D. _____

"I certify that I have personally examined and am familiar with the information submitted in this document, and I certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the information is true, accurate and complete to the best of my knowledge and belief. I understand that a false statement made in this information may be punishable as a criminal offense, in accordance with Section 22a-6 of the General Statutes, pursuant to Section 53a-157 of the General Statutes, and in accordance with any other applicable statute."

Signature - Title

Date

Monitoring results shall be recorded below and on the following pages as required in Sections 4 and 6 of this general permit. Parameters not required shall be marked "NA".

Date Sampled: _____

DSN: _____

Parameter	Result	Limit
Daily Flow		
VOCs as detected by EPA Method 601		1.0 mg/l
Total VOCs (EPA Method 601 & 602)		5.0 mg/l
Oil & Grease - Hydrocarbon Fraction		100 mg/l
MTBE		1.0 mg/l
Total Lead		0.1 mg/l
Arsenic		0.1 mg/l
Barium		5.0 mg/l
Beryllium		2.0 mg/l
Boron		5.0 mg/l
Cadmium		0.1 mg/l
Chromium (total)		1.0 mg/l
Chromium (hexavalent)		0.1 mg/l
Cobalt		2.0 mg/l
Copper		1.0 mg/l
Magnesium		50 mg/l
Mercury		0.005 mg/l
Nickel		1.0 mg/l
Selenium		1.0 mg/l
Silver		0.1 mg/l
Thallium		1.0 mg/l
Tin		2.0 mg/l

Parameter	Result	Limit	
Vanadium		1.0 mg/l	
Zinc		1.0 mg/l	
Total Cyanide		0.6 mg/l	
Amenable Cyanide		0.1 mg/l	
Phenols (EPA Method 625)		1.0 mg/l	
Pthalate Esters (EPA Method 606)		2.0 mg/l	
Polynuclear Aromatic Hydrocarbons (PAHs) (EPA Method)		0.5 mg/l	
Base Neutral/Acid Extractables (BNAs) (EPA Method 625, Excluding PAHs & Phenols)		1.0 mg/l	
Pesticides (EPA Method 608)			
Aldrin		1.5 ug/l	
alpha-BHC		1.0 ug/l	
beta-BHC		1.0 ug/l	
delta-BHC		1.0 ug/l	
gamma-BHC (Lindane)		2.0 ug/l	
Chlordane (technical)		20 ug/l	
4,4' - DDD, plus 4,4' - DDE, plus 4,4' - DDT Combined		0.2 ug/l	
Dieldrin		10 ug/l	
Endosulfan I		2.0 ug/l	
Endosulfan II		2.0 ug/l	
Endosulfan Sulfate		2.0 ug/l	
Endrin		1.0 ug/l	
Endrin aldehyde		1.0 ug/l	
Heptachlor		0.6 ug/l	
Heptachlor epoxide		0.4 ug/l	
Methoxychlor		360 ug/l	
Toxaphene		10 ug/l	
Chlorinated Herbicides (EPA Method 615)			
2,4 D plus 2,4 DB		700 ug/l	
2,4,5 T		10 ug/l	
2,4,5 TP (Silvex)		10 ug/l	
Dicamba		10 ug/l	
PCBs (EPA Method 608)			
Sum of all detected PCBs shall not exceed 1.0 ug/l.			
Parameter	Result	Parameter	Result
PCB - 1016		Other PCBs if present:	
PCB - 1221			
PCB - 1232			
PCB - 1242			
PCB - 1248			
PCB - 1254			
PCB - 1260		Total PCBs:	

Submit to: DMR SECTION
WATER MANAGEMENT BUREAU/PERD
DEPARTMENT OF ENVIRONMENTAL PROTECTION
79 ELM STREET, HARTFORD, CT 06106-5127

Summarize corrective actions on additional sheets.
Results to be maintained on site, and be submitted
as required by Section 6 (e) (1) and (2) of this general
permit.

Appendix D

Willow Brook/Willow Brook Pond
Dust Control Plan

**DUST CONTROL PLAN
FOR
UNITED TECHNOLOGIES CORPORATION
PRATT & WHITNEY
WILLOW BROOK AND WILLOW BROOK POND
EAST HARTFORD, CT**

**May 2001
Revised July 2001**

**Prepared for

UNITED TECHNOLOGIES CORPORATION
PRATT & WHITNEY
400 Main Street
East Hartford, Connecticut**

**Prepared by

LOUREIRO ENGINEERING ASSOCIATES
100 Northwest Drive
Plainville, Connecticut**

Comm. No. 88UT103

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4. NOTIFICATION AND CORRECTIVE ACTION PROCEDURES	4-1

Attachments

Attachment A Dust and Wind Monitoring Daily Log Sheet



1. INTRODUCTION

This Dust Control Plan has been developed to outline the operational controls, monitoring requirements, and notification procedures to be implemented during the performance of the Willow Brook/Willow Brook Pond polychlorinated biphenyl (PCB) remediation project at the Pratt & Whitney (P&W) facility in East Hartford, Connecticut. As the project involves the excavation of wet soil and sediment, the generation of dust as a result of excavation and material handling activities is not anticipated to be a significant concern. This plan is organized to present the operational controls to be implemented during the project to minimize the generation of dust, to control the dust that is generated, to define monitoring requirements to ensure that abutting residents and P&W facility workers are not exposed to airborne particulate matter beyond applicable threshold levels, and to establish notification procedures and corrective actions to be implemented in the event applicable particulate thresholds are exceeded.

The action level for particulate matter in air (dust) established for this project is $150 \mu\text{g}/\text{m}^3$ in air based on a time-weighted-average over a single 1-hour period.



2. OPERATIONAL CONTROLS

The following describes the proposed measures to be implemented during the construction activities associated with the remediation of Willow Brook and Willow Brook Pond. LEA-Cianci, Inc. (LCI) will implement remediation activities under the direct supervision of Loureiro Engineering Associates, Inc. (LEA)

2.1 Methods to Reduce Dust Creation

The following are the methods to be employed to minimize the potential for dust generation:

1. All vehicle transport routes will be maintained through the use of a mechanical sweeper;
2. All entrance and exit points from areas of excavation will be provided with an anti-tracking pad of crushed stone;
3. Transportation and disposal vendor vehicles leaving the site will be pressure washed to remove particulate matter;
4. All stockpiled materials awaiting offsite disposal will be staged within designated stockpile areas;
5. All stockpiled material from by-pass channel excavation will either be covered or dust suppressants (Section 2.2) will be applied;
6. Stockpile areas will be constructed with wind screens along the western, eastern and northern limits (predominant wind direction during the construction period is from the south and southwest);
7. Stockpiled material will either be covered or dust suppressants (Section 2.2) will be applied.

2.2 Methods to Control Dust

LCI will provide either or both of the following means to perform active dust control throughout the planned remediation activities. One method will be through the use of a full-time water truck to apply water on an as-needed basis to all active work areas. The second method will be through a truck-mounted mechanical broadcast spreader to apply chemical dust suppressants (calcium chloride or sodium chloride) to active work areas. The two methods may be implemented either alone or in conjunction with one another on an as needed basis to ensure the



150 $\mu\text{g}/\text{m}^3$ standard for the project is not exceeded. Active work areas include all areas being excavated or restored, all vehicle transport routes, and all staging and stockpiling areas for contaminated soil or backfill materials for the construction of the engineered controls.



3. MONITORING

Dust monitoring and wind direction monitoring will be performed on a daily basis during the following period:

- Dust and wind direction monitoring to commence upon initiation of demolition, excavation, or soil and sediment handling activities (material handling activities);
- Dust and wind direction monitoring to be discontinued upon completion of placement of all earthen materials associated with caps.

Wind direction monitoring will be performed through the use of a windsock to be strategically located within the limits of the project area (depicted as the Limits of Construction on Drawing I-1 of the Remedial Action Work Plan). Real-time dust monitoring will be performed by affixing the particulate monitoring device at a location downwind of material handling activities at the site when: 1) precipitation has not occurred during the previous 24 hours; and 2) when work is being performed at the site. The individual responsible for performing the dust monitoring will manually record the maximum and time-weighted concentration at a frequency of not greater than once per hour during periods of material handling activities at the site.

Notification procedures and corrective actions are described in Section 4.0. The portable particulate monitor will be a direct read personal monitor and will be calibrated and maintained in accordance with the manufacturer recommended intervals. The dust monitor will be capable of monitoring particulate matter less than 10 microns in size, capable of storing individual readings for a single 24-hour period, and will be provided with a digital readout of maximum and time-weighted-average concentrations for a 1-hour period. At a minimum, the particulate monitor will be calibrated prior to each use. A daily log sheet for dust and wind monitoring is provided as Appendix A.



4. NOTIFICATION AND CORRECTIVE ACTION PROCEDURES

This section presents procedures to be implemented in the event daily monitoring indicates an exceedance of the $150 \mu\text{g}/\text{m}^3$ time-weighted average standard for the project at any one individual location along the downwind perimeter of the project area. As a result, the procedures provided below are those that are necessary to correct the activities identified as resulting in the exceedance.

If during the hourly inspection and recording of particulate levels it is noted that the running time-weighted-average concentration of particulate matter exceeds $150 \mu\text{g}/\text{m}^3$ standard for the project, perform the following:

1. Remove the dust monitor from the sampling location and proceed to an upwind location and obtain a background measurement. If the working site particulate matter measurement is less than $100 \mu\text{g}/\text{m}^3$ above the background level, return the monitor to the original monitoring location and continue with hourly readings. If the working site particulate matter measurement is greater than $100 \mu\text{g}/\text{m}^3$ above the background level, perform the following tasks.
2. Immediately notify the onsite LCI Superintendent of the result via two-way radio or telephone;
3. Perform a visual inspection of the work area and identify the suspect activities generating dust;
4. Immediately proceed to the location of the suspected activities and inform workers to cease operations if operations are the cause of dust;
5. Immediately arrange for application of dust suppression materials as identified in Section 2.2;
6. Recommence project activities and repeat sampling at the original downwind sampling location where the exceedance was noted; and
7. Repeat steps 3 through 6, if necessary, until the particulate reading is less than the $150 \mu\text{g}/\text{m}^3$ standard over a one-hour period.



Attachment A

**Dust and Wind Monitoring
Daily Log Sheet**



Date: _____
Location of Exceedance: _____
Time: _____ a.m./p.m.

[illegible]

Communicate "lessons learned" at following day Health and Safety meeting.

Appendix E
Project Organization Chart

Willow Brook/Willow Brook Pond

UTC/P&W

UTC - Lauren Levine, Project Manager	Office (860) 728-6520
P&W - Elliot Dodge, Manager F&S	Office (860) 565-2879
P&W - William Moeller, EH&S Manager	Office (860) 565-8296
P&W - Gary Minor, Communications	Office (860) 565-4009
P&W - Martin DeEramo, Communications	Office (860) 565-6944
P&W - Scott Summerer, Security	Office (860) 565-5888

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LCI Construction Crew
Remedial Action Implementation